APPLICATION OF REMOTE SENSING DATA TO SURVEYS OF THE ALASKAN ENVIRONMENT

A Cooperative Program of the University of Alaska with User Organizations, including Local, State and Federal Government Agencies

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INTRODUCTION

Alaska remains as one of the prime areas for applications of remotely sensed data. This is particularly so if one measures utility not only by direct economic benefits but also by contributions to planners and by the value of data not otherwise obtainable. The vastness and undeveloped nature of most of the State of Alaska provide opportunities for applications of remote-sensing techniques which are unique on the national scene. The vast majority of Alaskan terrain is not accessible by conventional means of transportation, which means that field surveys quickly become prohibitively expensive if they involve significant areal extent. To illustrate, Alaska's land transportation system consists of about 14,000 km (9,000 miles) of roadways of all types (paved, primary, secondary, pioneer haul roads, and village streets) and one 725 km/railroad (450 miles). The State of Wyoming, by comparison the state next most noted for wide-open spaces, has eight times more roads per person, and thirty times more roads per area than does Alaska.

This high cost of access to most of Alaska exacts a penalty from those who manage natural resources. These resources are scattered over a 1-1/2 million square kilometers (586,000 square miles). If Alaska could be reformed to a convenient rectangular shape, one would require 45 non-overlapping ERTS frames merely to achieve one-time coverage of this land mass. The economy of a very limited population cannot afford to produce comprehensive resource inventories of a huge land mass by conventional survey methods. However, the Earth Resources Technology Satellite program has opened the door in an unprecedented way for up-to-date resource inventories and environmental surveys of the large,

undeveloped areas in Alaska. Agencies of all levels of government--federal, state and regional--and private firms are learning the value of synoptic coverage of inaccessible regions. Careful use of satellite data can generate beneficial results far beyond the capabilities of normal budgets.

The federal government agencies form the most active segment of the community of users of remotely sensed data. This is a reflection of the relative importance of land ownership in Alaska. Once the requirements of the Statehood Act and the Native Claims Settlement Act are met, there will be three major land holders in Alaska, but presently the federal government controls 90% of the land area. Eventually, the State will own 28%, although today the figure is far less. About two-thirds of State entitlement acreage has been selected, but most of these parcels are in varying stages of processing leading up to patents. Native corporations will gain control of 11% of Alaska's land within the next few years, and as such they will be by far the largest private owner of land resources. Thus, although State and Native entitlements are generous, the federal government will permanently remain a larger landlord than all others combined with control of some 59% of the total area of Alaska. For this reason, federal agencies in Alaska are the major users of remotely sensed data, and are likely to remain so.

A significant step toward coupling satellite data to resource management problems in Alaska was the major program of multidisciplinary studies undertaken by the University of Alaska in 1972 and funded by NASA's Goddard Space Flight Center (NAS5-21833). These 12 projects, which were completed during FY 1974, studied the feasibility of ERTS data applications for specific environmental surveys in the disciplines

of ecology, agriculture, hydrology, wildlife management, oceanography, geology, glaciology, volcanology and archaeology. The grant from NASA's Office of University Research and Application (NGL 02-001-092) draws on the results of these feasibility studies and extends the benefits of satellite data applications to the operational needs of mission-oriented agencies of federal, state and regional governments, as well as to private industry. The goal of this grant is to generate participation of public and private groups in on-going uses of remotely sensed data and, in the long term, to generate a self-supporting community of users for these data.

During the first grant period of FY 1973 this goal was achieved by implementing a variety of activities designed to encourage the participation of users in the ERTS program at levels which were most appropriate to the users' interests. These activities were expanded during FY 1974 and include:

1 - observation, coordination and information exchange
2 - training courses in interpretation of remotely sensed data
3 - data exchange
4 - consulting services
5 - data processing services
6 - user participation in University projects
7 - coordination of University and user projects
8 - University participation in user projects

More than two dozen agencies have participated in the ERTS program at one or more of the above levels, with the widest degree of involvement occurring initially in levels 1 through 5. These agencies are specifically identified in Table I, and some of the more significant activities are discussed in detail in the following section.

TABLE I - Cooperating Agencies

<u>Federal Government Agencies</u>

U. S. Army Corps of Engineers
USDI/Bureau of Mines
USDI/National Park Service
DOT/Federal Highways Administration
DOT/Federal Aviation Administration
U. S. Air Force/Alaskan Command
U. S. Coast Guard
USDI/Bureau of Indian Affairs
USDI/Bureau of Sport Fish & Wildlife
USDI/Alaska Power Administration
NOAA/Auke Bay Fisheries Laboratory
NOAA/National Weather Service

<u>State Government Agencies</u>

Department of Highways
Department of Fish & Game
Department of Education/State Library
Dept. of Natural Resources/Geol. Survey
Dept. of Natural Resources/Div. of Lands
Dept. of Economic Devel./Indust. Devel.
Dept. of Public Works/Div. of Aviation
Dept. of Environmental Conservation
Office of the Governor/Planning & Research

<u>Regional & Local Government Agencies</u>

City of Nenana
City of Fairbanks
Fairbanks North Star Borough
City and Borough of Juneau
Greater Anchorage Area Borough
Kenai Peninsula Borough
Ketchikan Gateway Borough
Matanuska-Susitna Borough

<u>Other Organizations</u>

Kross & Associates
Woodward, Lundgren & Associates
Alyeska Pipeline Service Company
CH_2M/Hill Alaska, Engineers
Lost River Mining Corp., Ltd.
Humble Oil & Refining Company
Woodward-Envicon Inc.
Environment/Alaska
Resource Associates of Alaska, Inc.
U. S. Steel Corporation
Marathon Oil Company
Tanana Chiefs Conference
NANA Regional Corporation
Arctic Environmental Information
& Data Center
Fisheries Extension Service
Northland Wood Products
Gulf Oil Company
Atlantic-Richfield Company
Shell Oil Company
ESSO Production Research Company
Boston Museum of Science
Union Carbide Corporation
Doyon, Ltd.
Calista Corporation
Alaska Travel Publications, Inc.
INEXCO Mining Company
R & M Engineering & Geological Consultants
AMAX Coal Company
Enplan Corporation

SUMMARY OF ACTIVITIES IN FY 1974

The activities of the past year have covered the broad range of participation levels listed in the introduction with a steadily increasing emphasis toward the higher levels.

COORDINATION AND INFORMATION EXCHANGE

From the beginning, our participation in the NASA ERTS Program was viewed as a coordinated statewide activity in which operational agencies of government and industry would be involved. NASA Grant NGL 02-001-092 has provided the means to achieve this statewide coordination.

We have established good rapport with most of the agencies involved in environmental and resource surveys in the state. These agencies are aware of our activities and, in many cases, they are utilizing our capabilities. We are also aware of their activities and needs, and we usually have access on an individual case basis to environmental information and data products which they have.

An important result of this coordination activity is that there now exists in Alaska a de facto, cross-agency referral system on particular environmental activities and needs in which we often act as a clearinghouse.

TRAINING AND WORKSHOPS

An initial, broad-based training program was conducted throughout the state during the preceding year. More recently, we have built upon this earlier foundation by placing the emphasis upon training the individual agency investigators, or groups of them, faced with special quasi-operational problems (levels 6 to 8). On the basis of this individualized

training process, many agency investigators are familiar with the capabilities of ERTS data processing and interpretation techniques for their own needs. Several of them are now capable of independent use of some of our data processing equipment.

As part of the training process, we have presented a number of lectures on ERTS data applications. Many of these lectures were included in the proceedings of various symposia and meetings. Appendix A contains a list of these lectures. Reprints of some of them are available. Reprints, particularly those describing Alaskan applications, are very useful as training tools, because the user can study them at his leisure and come back with thoughtful questions, as well as a developed plan for similar analyses in areas of interest to his agency.

We have also prepared a number of display boards which illustrate applications of ERTS data in various disciplines. These are prominently displayed for maximum public impact in the entrance of the Geophysical Institute building and in the ERTS data users room. This has proven to be very effective both in developing ideas for applications among casual visitors and in providing concrete terms of reference for visitors who come with ill-defined needs and plans.

DATA EXCHANGE AND CONSULTING SERVICES

An important service to the community of users within Alaska is the publishing of information catalogs and listings of available ERTS and aircraft imagery. While all data are available from national data banks, the University archives only low-cloud-cover Alaskan data which are most relevant to Alaskan needs. The user agency needs to know what data are available when gathering information for problem solving. Part

of the University's coordination effort includes the distribution of catalogs which meets the user's need for browsing among available data or searching for some specific regional coverage. As the body of locally stored data grows, providing an up-to-date bibliography of the total Alaska library remains a significant part of our activities. A typical catalog of Alaskan ERTS data is included in Appendix B.

The operation of the ERTS Data Library frequently involves consulting services of at least four types:

1) Assisting the user in selecting the data which have the greatest potential of satisfying his needs.
2) Assisting the user in preparing orders for standard data products from the EROS Data Center. This is particularly pertinent when the need for data is not immediate and standard data products are satisfactory for the purpose.
3) Assisting the user in preparing a local work order for custom data products (images enhanced for the purpose of the investigation, density-sliced images, etc.).
4) Advising the user on data analyses and data interpretation facilities available either locally or at major laboratories outside Alaska.

DATA PROCESSING SERVICES

An essential aid to new users of remotely sensing data has been the services of the centralized facilities for specialized data processing and handling at the University. It would be wasteful were each user agency to establish laboratory facilities and technical personnel to perform its own analysis and interpretation. A most practical activity

of the University is the processing of remote-sensing data either photographically or digitally to the specifications of the user agencies. This is handled by our facilities on a job order basis as parallel work to the research already under way. In some instances, the user agency is able to bear the costs of such direct services, but selected cases with high benefit/cost potential or demonstration projects may be funded from this proposed budget for direct services support. The justification for this funded support is that the benefit should not be denied to the public for lack of provision in current agency budgets for such an unforeseen opportunity. Care is used to avoid supporting what should be internal funding for the long-run requirements of each user agency.

Frequently it is the case that specific signatures, leading to specific thematic classification, are the essential elements that a user requires. These signature patterns are discernable only after extensive processing and interpretation of quantities of earlier data. The service of data processing with University computer facilities and the expertise of our personnel might long remain a necessary part of the services that user agencies must seek outside their own staff. Making our capability as widely available as possible throughout the state has enabled agency users to make much more significant progress in applying remote sensing technology than if they had to wait for liaison with some agency located outside the state. Also, owing to the wide flexibility of our own work with ERTS data, we are not likely to fall into stereotyped patterns of interpretation and data handling. The broader our interests in applications are spread within Alaska, the more alert and creative we become in working with each user's needs.

AGENCY PARTICIPATION IN UNIVERSITY ERTS PROJECTS

An excellent means for an agency investigator to become thoroughly familiar with ERTS data utilization is to participate in a University ERTS project in which he has a particular interest. Almost all of the initial University ERTS-1 projects involved agency participation to some degree. In one case an agency investigator was formally included as a co-investigator of the project. In four other cases the participation of agency investigators was described in the proposals. In one case investigators from the Alaska Department of Fish and Game and the U. S. Fish and Wildlife Services became so involved in a University ERTS-1 project that they are now co-investigators with University scientists in a ERTS-1 follow-on proposal.

In most cases the participation of agency investigators in University projects has generated additional interest as well as expertise in ERTS data utilization within these agencies, and it has resulted in University participation in agency projects as described in the next two subsections.

COORDINATION OF UNIVERSITY RESEARCH WITH USERS' OPERATIONAL NEEDS

This activity overlaps substantially the activities described in the previous and following sections. In particular, the philosophy of the NASA sponsored ERTS follow-on program states that the projects will be focused on users' operational needs rather than development and feasibility studies as was the case for the initial ERTS-1 Program.

There is also a range of users who cannot intimately participate in University research even though this research serves directly their operational needs. The activities under this grant provide for this

range of users by (1) determining in consultation what their priority needs are, (2) attempting to include these needs in compatible University research, and (3) keeping the agency informed on the progress of the research and ultimately providing it a report of the result.

An illustrative example of this situation is the case of the Alaska Department of Environmental Conservation which has a small budget as well as a small staff and cannot become involved in research owing to the excessive demands of its regulatory functions. One of the important needs of this department is a knowledge of sea-surface circulation of the Alaska coastal zone. This knowledge is necessary to predict the trajectories of potential oil spills and their extremely damaging effects on the Alaskan fisheries resources. On the basis of this need, a University ERTS-1 project was expanded in scope to provide a preliminary atlas of sea-surface circulation and sediment transport in the Alaskan coastal zone. The final report of this project is now in the hands of the department as well as other appropriate agencies, and the updated knowledge which it provides is being used as a contingency planning tool.

UNIVERSITY PARTICIPATION IN THE USER AGENCIES OPERATIONAL PROJECTS

This most important activity ranged widely from a quick response to an agency's limited need (e.g., the siting of logging roads by Northland Wood Products, based on one U-2 image) to longer-term assistance (e.g., resources surveys by the Joint Federal-State Land Use Planning Commission, based in part on many ERTS scenes in different formats). Owing to the great number of such projects, their varying complexity and needs, and often the inadequately known contribution of the results to agency

decisions, we found it difficult, initially, to properly document these projects. In order to partially resolve this problem, we prepared a "Special Project Form" which attempts to describe the project in a concise and specific manner. An illustrative number of completed "Special Project Forms" are included in Appendix C.

The primary purpose of this activity is to generate applications of remote-sensing technology to serve operational needs. Therefore, our guiding principle in these special projects has been to get the agency investigator deeply involved in the performance of the project from beginning to end. In this manner, not only are new applications achieved effectively, but the agency investigator is in a better position to participate in the administrative decisions based upon the results of the projects.

DESCRIPTION OF COOPERATIVE OPERATIONAL PROJECTS

As the potential benefits of remote-sensing became better known throughout Alaska, we began to emphasize project-oriented activities. Some are continuation of previous longer-term projects, such as assistance to the environmental surveys of the Joint Federal-State Land Use Planning Commission. Some are presently unforeseen projects, an example of which, during the last year, was the Tweedsmuir Glacier project where the glacier surged and dammed the major river, thus threatening to create a glacier-dammed lake and a potential disastrous flood. Others were planned projects whose needs are identified and listed below.

USGS Water Resources Division - monitoring surging glaciers

USA/Corps of Engineers - siting of small boat harbors in silt laden estuaries

USDI/BIA-BLM - resource analyses for Native land selections

USDA/USFS Institute of Northern Forestry - soils mapping and timber surveys

USDI - monitoring construction activities of Alaskan pipeline

Office of Governor, Director of Planning & Research - assistance with environmental content of regional profile atlases

Alaska Dept. of Natural Resources - surveillance and mapping of spruce beetles infestation

Alaska Dept. of Fish and Game - wildlife habitat mapping

Alaska Oil and Gas Association - near-shore ice dynamics and off-shore development.

The emphasis of the project-oriented activities is placed on demonstration projects. Most of the projects described above fall in this category. Over the long-run we encourage agencies who have participated in demonstration projects to support applications of ERTS data either from internal financial and personnel resources or through contractual arrangements with the University. An example of the former situation is the Joint Federal-State Land Use Planning Commission which is now proceeding on its own with only consulting services from the University. An example of the latter situation is Doyon, Ltd., the largest of twelve Native Regional Corporations, which helped to arrange a Bureau of Indian Affairs contract with the University to evaluate the mineral and forest resources potential of five areas where Doyon, Ltd. can select lands under the Alaska Native Claims Settlement Act.

Illustrative descriptions of recent or current projects are described below and in a more concise format in Appendix C.

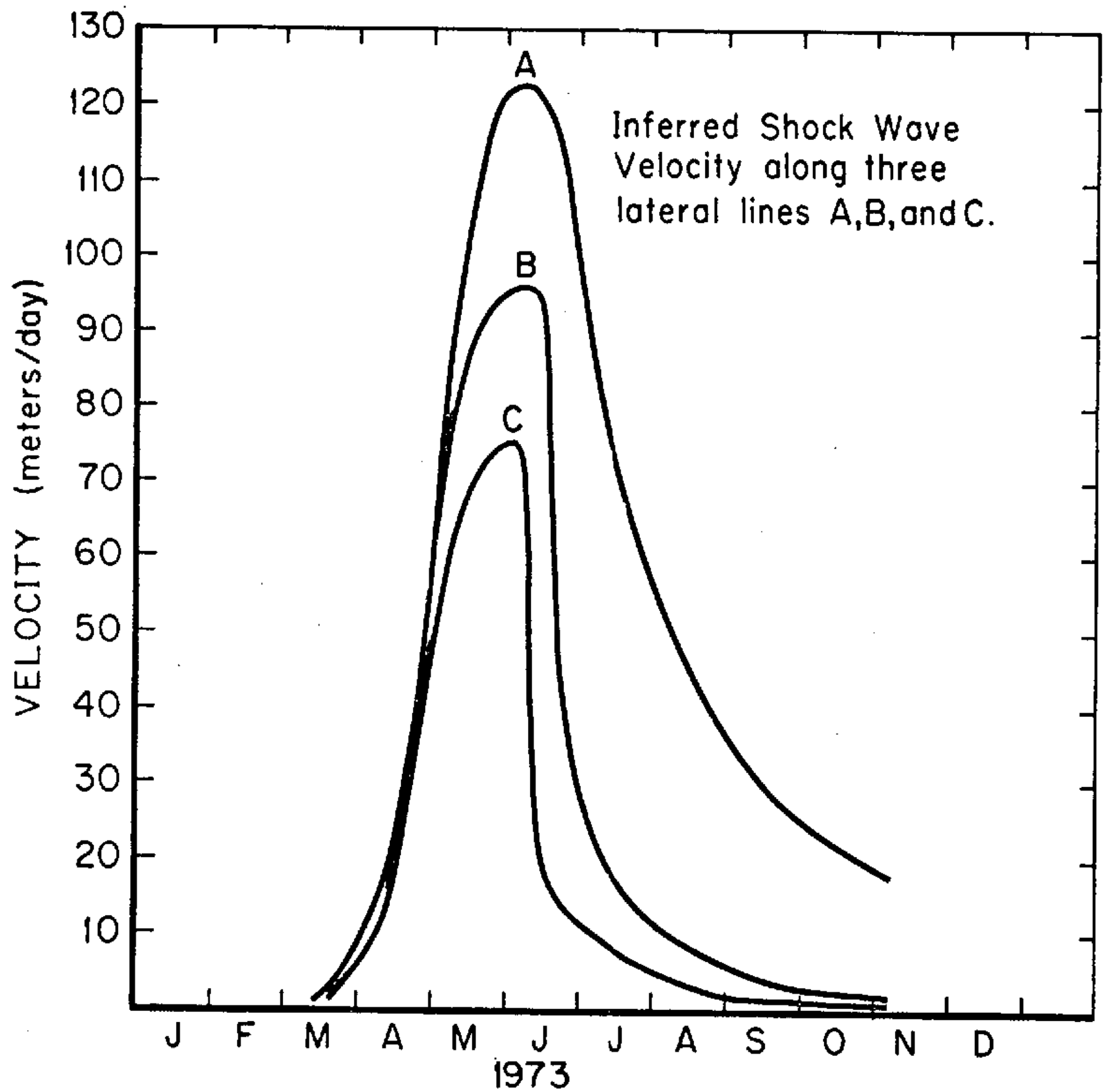
USGS/Water Resource Division

This agency has frequently utilized ERTS imagery from our photo lab for hydrological applications, particularly that of surging glacier-dammed lakes in Alaska. The Tweedsmuir Glacier was discovered to be surging in October 1973 by Canadian investigators during routine aerial reconnaissance flights. This glacier, Figure 1, is located about 520 km northwest of Juneau in British Columbia, near the Alaska border. This glacier is 70 km long and 13 km wide. Its tongue spreads out in the Alsek River valley and encroaches ten miles along the river bed, forcing the river into a wild, narrow gorge along the glacier's eastern margin.

After we learned the glacier was surging, we located all the cloud-free ERTS photos of the glacier that were in the University ERTS library in Fairbanks. Seven photos, representing twelve months of time, were enlarged to a scale of 1:50,000, for a detailed, elapsed-time examination of the glacier action. A shock wave, Figure 2, was found to have progressed down the glacier, the margin expanding, the moraine pattern deforming, and the marginal valley deepening as the ice grew thicker. This is believed to be the first time that a complete shock-wave history has been photographically imaged throughout the active surge cycle. This is a particularly interesting ERTS application, because the surge was largely ended when it was first discovered, but the satellite had routinely acquired the data during the previous months, and the data were immediately and economically available in the University ERTS library.

The Tweedsmuir Glacier project has more than purely scientific interest. There was reason to expect that in the summer of 1974 the

Figure 1. Enlargement of an ERTS scene illustrating Tweedsmuir Glacier at a scale of 1:50,000. Note the extreme deformation of the moraine structure at the base of the glacier and the expansion of its margin along the Alsek River.



TWEEDSMUIR GLACIER SURGE

Figure 2

glacier's surge would have dammed the main river channel and formed a lake of massive proportions upstream. Evidence exists that gigantic floods have swept the Alsek valley in the past when the glacier had previously dammed the river in this same canyon, creating a lake 20 km long. There are giant ripple marks in gravel bars, a lack of mature forests and denuded valley walls up to 100 meters above the valley floor which all attest to the magnitude of a previous sudden release of huge volumes of glacier-dammed flood waters.

On the basis of what the ERTS imagery demonstrated about the behavior of the glacier, Canadian and U. S. investigators maintained surveillance of the status of the river through the glacier canyon to watch for a possible lake formation behind the glacier during spring and summer 1974. If this should have again occurred there would have been sudden, and perhaps repeated, massive releases of water once the ice dam failed during the summer runoff season. These circumstances could have caused disastrous flooding in the downstream channel and in Dry Bay, Alaska. Fortunately, as demonstrated by continuing surveillance by satellite and aircraft, the ice dam formed from the glacier surge of 1973-74 but was not of sufficient size to completely block the river. In this instance, satellite remote-sensing applications did not result in averting or minimizing a natural disaster, but they surely were instrumental in defining the magnitude of the anomalous ice flow such that it was recognized as a major threat to hydrologic conditions along the Alsek River valley in British Columbia and Alaska. Surveillance of the Tweedsmuir Glacier action is continuing from ERTS imagery and aircraft reconnaissance.

USA/Corps of Engineers (Coastal Engineering Research Center)

The Corps of Engineers has had long-standing problems in Alaska with the design of small craft harbors owing to excessive maintenance costs from a continuing need for dredging. These shoaling problems result from the unusually high suspended sediment loads of many Alaskan estuaries. In response to an inquiry in spring 1974, we have recommended to the Corps that remote-sensing data should be useful during the harbor site selection process to minimize sedimentation problems, and a joint demonstration project was formulated (Appendix D).

The goal of this project is to relate the gray scale density levels from ERTS imagery and low altitude, high resolution aerial photography to surface suspended sediment concentration in a typical sediment-laden Alaskan estuary. This is a pilot project designed to test the feasibility of using remote-sensing techniques to site small craft harbors such that sedimentation problems do not make the operation of the harbor uneconomic to maintain.

The reflectance of water depends upon the amount and type of suspended sediment load near the surface. These brightness-sediment relations likely will vary from river to river, but they should be relatively constant within a given estuarine environment, with minor variations due to tide conditions. To test this assumption, we have planned a demonstration project at the mouth of the Kenai River on Cook Inlet where interpretation of ERTS imagery suggested favorable harbor sites, but the ERTS images lacked sufficient ground resolution. Ground truth in the form of water samples acquired simultaneously with multispectral aerial photography will be analyzed to determine the usefulness of remote-sensing techniques to locate areas with minimum suspended sediment loads.

The results of analyses of the water samples and the aircraft photos will be reported in a report jointly authored by the University of Alaska and the Coastal Engineering Research Center.

USDI/Bureau of Indian Affairs and Doyon Ltd.

The Alaska Native Claims Settlement Act of 1971 provided that the 100,000 Indians, Eskimos and Aleuts of Alaska could select 40 million acres of surface and subsurface estate and receive $962.5 million in cash from the U. S. Government over a period of 11 years. This is forcing a massive redistribution of land ownership and potential wealth in Alaska that will have profound socio-economic effects upon the State and its Native people within a short period of time.

As a result of the Act, Native corporations have been receiving requests and proposals from industry for the utilization and exploitation of their land resources. For the most part, the Natives are presently attempting to establish objectives which will aid them in selecting the land acreage provided to them by the Act and in evaluating requests for development of these lands.

Doyon, Ltd. is one of the twelve regional corporations formed in response to the Act. Doyon's corporate boundaries encompass an ethnic region which represents over 37% of the State of Alaska. This particular land entitlement is complicated by federal and state withdrawals which are large, varied, far-flung, and contain a multitude of resources including lands known to be mineralized or forested with spruce and birch of commercial quality. The obligation to develop goals, objectives, priorities and land management policies is staggering owing to the need

for resource inventories and the complex decisions for specific land selections from these resource analyses.

There are 34 village corporations in Doyon's region which will receive surface title to more than 3.6 million acres. This is coupled with the Doyon regional entitlement of more than 12 million acres, from which about one-third must be selected from irregularly shaped blocks, which are called Regional Deficiency Areas. A comprehensive resource inventory is complicated by remoteness, the lack of existing information, the spatial aspects of the withdrawals themselves, and by a stringent time deadline. All native selections must be completed by December 1975. Furthermore, all regional deficiency lands available for the selection process exceed the actual entitlement by a factor of three. This means that Doyon, Ltd. must surrender more than two-thirds of their regional deficiency areas to the federal government by December 1975. In this process, they want to be confident they are retaining those lands which best meet their objectives, which include the development of natural resources.

In March 1974, we undertook a pilot project on behalf of the Bureau of Indian Affairs to demonstrate the application of remote-sensing data to land selection and management activities of Alaska Natives. The project was conceived, initiated and supervised with the support of the present NASA grant, but the disciplinary research activities were eventually supported financially by the Bureau of Indian Affairs and logistically by Doyon, Ltd., which participated in the investigation. The goal was to utilize all available resource data, including ERTS imagery, to provide a resource inventory for land selection decisions in five of

Doyon, Ltd.'s regional deficiency areas. ERTS images are used to provide the end products (thematic maps) and as underlays for selection townships at a scale of 1:250,000. These products form a planning tool to circumvent the lack of extensive ground survey data. Additionally, literature reviews are made to further support the recommendations for land selection decisions. These resource inventories are aimed at two major interests of Doyon, Ltd. - vegetation and mineralization. The vegetation analysis emphasizes the mapping of commercial forests although lands suitable for wildlife habitat and agriculture are also of interest. The mineralization analyses are directed toward the identification of areas with good potential for the presence of hard rock minerals. (The petroleum potential has already been evaluated by oil companies.)

The methods of analysis include the interpretation of ERTS imagery correlated with existing information. For the vegetation analysis ERTS images are reconstituted in simulated color infrared formats at a scale of 1:250,000 and then interpreted by identifying color units. In addition, winter black and white ERTS imagery is utilized to refine the commercial timber thematic maps. Available aerial photography (NASA U-2 and NP3A, USDA/Forest Service and USDI/BLM) along a few flight lines is used as ground-truth leading to establishment of color signatures. The vegetation maps produced by this analysis will be verified during summer 1974 by oblique aerial photography of selected areas.

For the mineralization analysis we seek to answer two questions: first, which areas of the regions can be identified as potential metallogenic provinces, and second, what geological studies should be made to

further evaluate the mineral potential of the favorable areas? For this purpose, ERTS images in both simulated color infrared and low sun-angle black and white format are used, in conjunction with the results of existing field studies, to map geologic units and are overlayed with maps of known mineral districts and mining claims. Thus, while the analysis does not identify nor locate mineral deposits directly, it is very useful in identifying areas where further prospecting efforts should be undertaken. For these areas, the analysis will lead to the recommendation of a program of specific field investigations (stream sediment analysis, soil and rock samples) to further evaluate and delineate the mineral potential.

The end product of the survey will be a folio of written material with a series of maps at a scale of 1:250,000 which indicate a hierarchy of most favorable townships which would maximize the future opportunities for mineral extraction and forest utilization.

One of Doyon, Ltd.'s regional deficiency areas, the Kaltag area, has been completed (see Appendix E) and presented to the Board of Directors of Doyon, Ltd. The other four areas are scheduled for completion by December 31, 1974. Doyon, Ltd. and the Bureau of Indian Affairs are delighted with the analysis of the first area for three reasons:

(1) it clearly identifies the townships which have resource development potential and therefore should be selected by Doyon, Ltd. The previously available data base was extremely limited and inadequate for land selection decisions;

(2) it provides a good basis for on-going negotiations with mining companies for prospecting activities of specific types and in

specific areas, rather than the normal practice (in Alaska) of expensive saturation sampling;

(3) the analysis clearly shows that the resource potential of the regional deficiency area would be maximized by a modification of the boundaries of the withdrawal. On the basis of this result, Doyon, Ltd. plans to request a boundary change to the Secretary of the Interior, Mr. Rogers Morton, in the near future.

Alaska Department of Natural Resources, Division of Lands

In response to the remote-sensing short course presented in Anchorage, the State Forester's Office requested our help in investigating the feasibility of using ERTS data to monitor the spread of a major spruce beetle outbreak in the Cook Inlet region. These insect infestations have been mapped from aerial photography in extensive areas on the Kenai Peninsula and on the west side of Cook Inlet. Mature spruce trees usually are killed by the second year after a heavy attack by dendroctonus rufipennis, and appear on color infrared film as a gray-blue color. Aerial surveillance on a repetitive basis is too costly a method to use to maintain surveillance over wide regions of the state. In addition to the known infestation in southcentral Alaska, it is expected that there are outbreaks throughout the more remote regions of the interior. If satellite imagery could identify diseased spruce stands, this would be a very beneficial tool for managers of timber resources. In particular, they would be able to better plan and schedule the sale of salvage rights to the infected timber, thereby limiting the spread of the infestation and realizing an income from the salvaged forest harvest.

The importance of the spruce beetle infestation remains a current focus of activity by the U. S. Forest Service and the Alaska Department of Natural Resources, although it was first detected in 1970. Aerial observations and field data show that some infestations are declining where heavy stand depletion has already occurred (such as the Tyonek Indian Reservation). Where abundant host stands exist, the spread of beetle infestation is continuing in approximately 103,000 acres. Figure 3 maps the status of beetle infestation in 1974. Currently the heaviest concentration of beetles on the west side of Cook Inlet is in a region between the McArthur and Chakachatna rivers, while the areas of greatest accumulation of dead white spruce is north of the Tyonek Indian Reservation and southeast of Beluga Lake.

On the east shore of Cook Inlet (Kenai Peninsula), the beetle activity is subsiding. Active infestations appear on federal, state and private lands numbering approximately 53,000 acres, concentrated chiefly southwest of Turnagain Arm and Chickaloon Bay.

Initial efforts to identify spruce beetle kills on ERTS imagery have lacked success owing to several factors. Useable summer data did not exist for the west side of Cook Inlet, and the Kenai Peninsula study was complicated by the lack of homogeneous stands of white spruce and by the presence of fire scars. Typically the spruce here was mixed with broad leafed species in various mosaic patterns which made it difficult to establish training sites. A further complication was a mix of fire-killed spruce from a major wildfire in the Swanson River area of the Kenai Peninsula in 1969. The fire-killed trees spectrally resemble insect-killed trees.

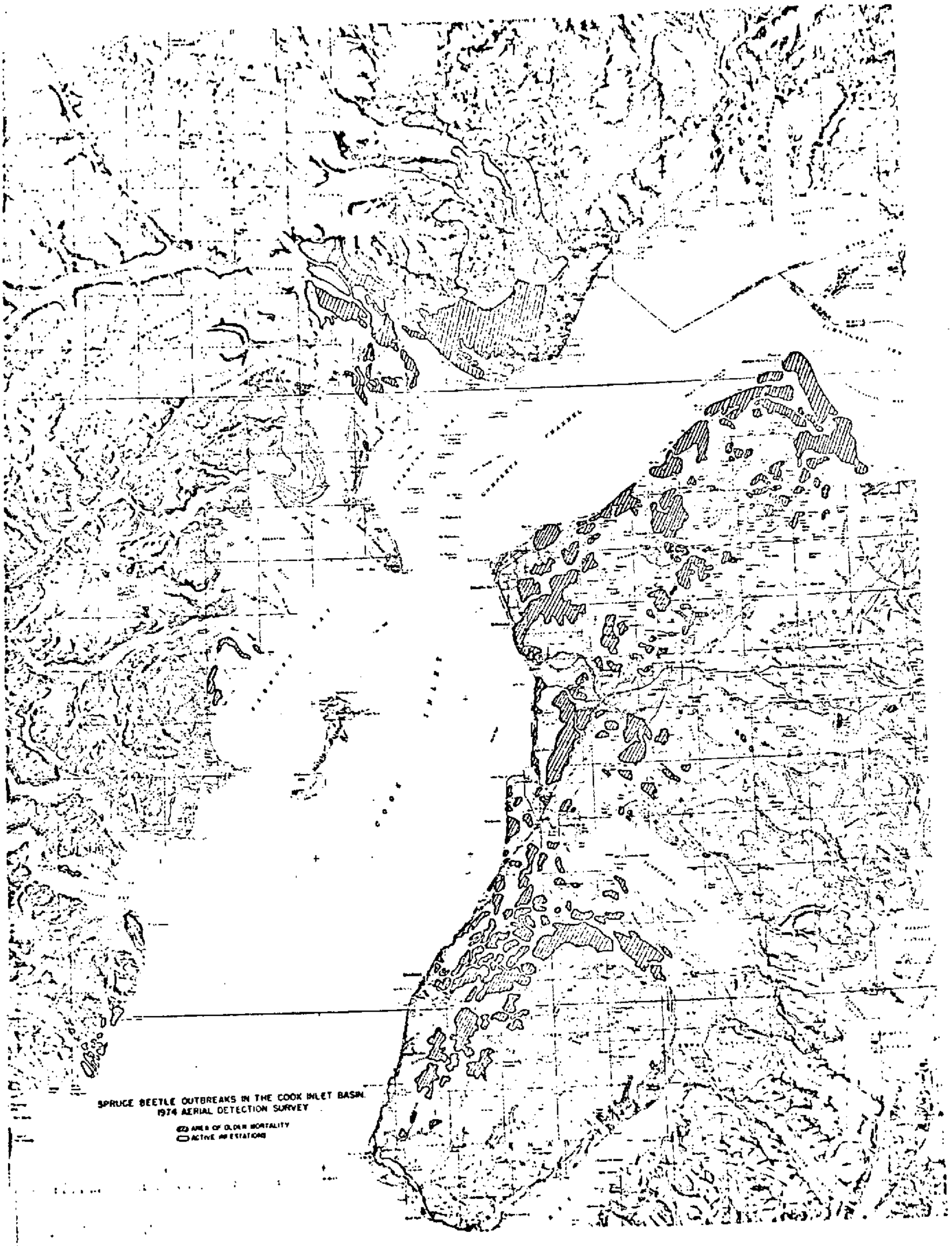

SPRUCE BEETLE OUTBREAKS IN THE COOK INLET BASIN
1974 AERIAL DETECTION SURVEY

Figure 3

The study of the west shore of Cook Inlet holds the best promise of useable results because larger stands of white spruce occur there, along with the most concentrated attacks of the insects. The sole cloud-free summer ERTS image of that region lacked MSS band 7 and therefore no digital tape nor reconstituted color was available. Recently GSFC/NDPF acted favorably to our request for special handling of this scene and digital tapes have been made. We plan to pursue a diseased spruce signature analysis with this tape and others that may have become available from 1974 passes of the satellite.

We retained an active participation in the spruce beetle mapping efforts of the state and federal forestry agencies in spite of the temporary failure to produce results from satellite data. Because of the shortfall of FY 1974 funds in the state agency's budget, we supported the color infrared film, processing and interpretation costs of the aerial surveillance flights. This was deemed appropriate to the purpose of the NASA grant owing to the agency's active interest in using all available remote sensing tools in their operational activities.

From the up-to-date photo coverage of the affected areas west of Cook Inlet, the State Division of Lands in 1974 completed a timber harvest salvage sale comprising 425 million board feet at a bid price of more than $285,000. Although useable satellite data was unavailable to support the needs of this project in a timely fashion to contribute toward the decision-making process, we aided the agency in acquiring aircraft remote sensing imagery to accomplish its goal. Future cooperative efforts will be devoted to determining the feasibility of computer surveillance of spruce-killed areas using ERTS digital data.

Northland Wood Products

This Fairbanks firm is engaged in timber harvest and commercial sawmill operations. It was the successful bidder on a timber sale by the State Division of Lands in the Goldstream Valley, 30 miles northwest of Fairbanks. They requested our assistance in using remote-sensing techniques to minimize logging road construction and to thereby serve most efficiently the timber harvest requirements while protecting the environment to the greatest possible extent. It is becoming widely recognized that logging roads, with their relative disregard for grade and hydrologic considerations, tend to abuse the ecology over a much larger area than that of their immediate vicinity.

The obstacle to good road planning was that the aerial photography of the timber sale area was decade-old U. S. Forest Service photography in black and white format. While adequate for estimating timber yields, these photos did not reflect wildfire suppression activity of recent years. The logging firm desired to make use of the existing fire trails for road building purposes, but the old imagery predated these fire trails. The scale requirement for this application was beyond the capability of ERTS data; however, the July 1974 U-2 mission in Alaska by the NASA-Ames Research Center provided ideal high resolution, color-infrared coverage of the timber sale area.

At the firm's request, we prepared in our lab a 1:40,000 scale enlargement of the timber harvest area and trained the firm's investigators in the use of our Zoom Transfer Scope. On the basis of this photo, used as a planning tool and field survey guide, Northland Wood reports they saved two man-weeks of road reconnaissance work. Even more

important to them than the time saved in road layout work was the better and more reliable decisions that were made for locating logging roads. Frequently, after many days in the forest on foot and by tractor, road trails are begun only to be abandoned when unforeseen bog or permafrost conditions are encountered. On the basis of the recently acquired high altitude imagery, the logging road plans have been made with a much higher degree of confidence than usual.

Another important decision-making benefit is that the firm was able to locate the roads along existing fire trails in many instances. This minimized road construction costs and unnecessary environmental disturbances.

Arctic Environment Information and Data Center (AEIDC)

The Division of Planning Research of the Office of the Governor of Alaska has asked AEIDC to compile a series of Alaska Regional Profiles. There will be six Regional Profiles (or Atlases) covering the South-Central, Arctic, Northwest, Southwest, Yukon (or Interior), and Southeast regions, respectively. These profiles are intended to become the primary planning tool for the management and development of natural resources in the State of Alaska.

In view of the stringent time schedule for the preparation of these regional profiles it will not be possible for AEIDC to perform new environmental surveys for input to the profiles. Instead they will compile and edit information from the existing environmental data base, primarily the resource information acquired by the Joint Federal-State Land Use Planning Commission (LUPC) and other State and Federal agencies concerned with the Alaskan environment.

Knowing our substantial contributions to the work of the Planning Commission over the last two years, AEIDC has requested our assistance in providing remote-sensing data and interpretation to supplement the existing data base. The South-Central Regional Profile was recently published and received wide acclaim from both the public and private sector as the first comprehensive source of information on the Alaskan environment and resources. The request for assistance from AEIDC came as this first profile was going to press; therefore we contributed to it only indirectly through our prior contributions to LUPC. Our contributions to the second Arctic Regional Profile, now going to press, are more substantive, but still moderate for the same reason. It does feature a black and white ERTS mosaic of Arctic Alaska as well as U-2 aerial photographs and thematic maps based on ERTS imagery. We are now making substantial contributions to the other four regional profiles in the way of updating vegetation and land-form boundaries shown on existing maps and providing thematic maps for areas where little or no information presently exists.

It is difficult to quantify the immediate economic benefits of our contributions to this project. Nevertheless, the planning process is of such paramount importance at this early stage of Alaska's economic development that we feel our contributions to the Alaska Regional Profiles is one of the most important activities we should undertake with the resources of the grant. The establishment of a remote-sensing office at AEIDC, Anchorage (with University funds) will contribute to this goal.

USDI/National Park Service-Espenberg Peninsula Vegetation Map

A preliminary vegetation map of the Chukchi-Imuruk Biological Survey region on the Espenberg Peninsula district of north-central Seward Peninsula was prepared for the National Park Service. This analysis was prepared from field survey results coupled with the interpretation of the best available imagery. This map is considered preliminary, pending further ground truth control, refinement of classification units, and accuracy analysis using aerial photographs (see Appendix F).

Photo interpretation techniques were applied to a portion of a reconstituted false-color infrared scene of scene 1009-22092. Eight color units were identified on the basis of hue, intensity and brightness information as representative of various spectral signatures. Many of these signatures were associated with plant community or vegetative types as well as non-vegetated areas such as sand dunes, coastal mud flats and rocky barrens.

The preliminary vegetation map contains 14 map unit classes, and they are of three basic kinds: prevailing stands of a single predominant plant community, mosaic areas occupied by two or more vegetation types, and landscape features not described in terms of vegetation. The map unit classifications include tussock-shrub tundra, lowland wet tundra mosaic, shrub thicket, drained and partially drained thaw lakes, wet meadow, dwarf shrub tundra, coastal meadows-dwarf shrub tundra mosaic, riparian and floodplain wet meadows, estuarine marsh and mud flat, coastal sand dunes, meadow shrub thicket, wet meadow-shrub thicket complex, and shallow salt water.

CONCLUSIONS AND RECOMMENDATIONS

The need for applications of remote-sensing data to resource inventories and environmental surveys in Alaska continues to grow as the State becomes more involved in national problems and issues such as the energy crisis, the shortage of raw materials, fisheries rehabilitation and the imminent settlement of the Alaskan Natives' land claims. As a result of our activities over the past two years, an increasing cross-section of public and private agencies in Alaska is now using remote-sensing data (ERTS and aircraft) in the performance of their operational activities and requesting assistance in data interpretation from the University. There is still a strong need to introduce new agencies and investigators to the operational benefits of remote-sensing and to upgrade current users to a more extensive and intensive utilization of remote-sensing data and techniques available through University research. In seeking renewed support from NASA's Office of University Affairs, the University will continue to provide remote-sensing assistance to operational agencies of government and industry at a variety of levels appropriate to their interests, namely:

1 - Observation, coordination and information exchange
2 - Training courses and workshops
3 - Data exchange
4 - Consulting services
5 - Data processing services
6 - User participation in University research projects
7 - Coordination of University research with users' projects
8 - University participation in the operational projects of user agencies.

The experience of the past two years has demonstrated the effectiveness of this broad-based approach in overcoming the initial apprehensiveness of new users of modern technologies. The introduction of

new users to the cooperative program at levels 1, 2, 3 or 4 as well as 7 will continue, but we recommend that an increasing amount of the NASA grant resources be directed toward the higher levels of participation in cooperative projects. This change of emphasis is justified for three reasons: first, many potential Alaskan users have now been introduced to remote-sensing; second, it is expected that the USDI EROS Program will soon provide financial and logistic support for our data library activities, and third, the establishment of a remote-sensing office in Anchorage, with University funds, will provide valuable additional assistance to remote-sensing data users in south-central Alaska.

APPENDIX A

List of reports prepared in part under grant NGL 02-001-092

*Miller, J. M. and A. E. Belon, A multidisciplinary survey for the management of Alaskan resources utilizing ERTS imagery, Proceedings of Symposium on Significant Results obtained from the Earth Resources Technology Satellite, Vol. II, 39-49, NASA/GSFC, 1973.

*Anderson, J. H., L. Shapiro and A. E. Belon, Vegetative and geologic mapping of western Seward Peninsula, Alaska, based on ERTS-1 imagery, Proceedings of Symposium on Significant Results obtained from the Earth Resources Satellite, Vol. I, 67-75, NASA/GSFC, 1973.

*Miller, J. M. and A. E. Belon, "Alaska and the Super Eye", Alaska Magazine, Vol. XXXIX, 34-38, September 1973.

*Belon, A. E. and J. M. Miller, Remote Sensing by Satellite -- Application to the Alaska Environment and Resources, 1972-73 Annual Report, 127-147, University of Alaska, Geophysical Institute, 1973.

Belon, A. E. and J. M. Miller, The role of satellite remote sensing in Alaska's future, Proceedings of the Alaska Survey and Mapping Convention, Feb. 6-8, 1974, in print.

*Miller, J. M. and A. E. Belon, The University of Alaska ERTS Program, Proceedings of the 24th Alaska Science Conference "Climate of the Arctic", University of Alaska Press, in press, 1975.

*Belon, A. E. and J. M. Miller, Application of ERTS data to resources surveys of Alaska, Proceedings of the Third ERTS-1 Symposium, Vol. I, 1899-1907, NASA/GSFC, 1974.

*Miller, J. M., Environmental Surveys in Alaska based upon ERTS data, Proceedings of the Third ERTS-1 Symposium, Vol. II, 12-40, NASA/GSFC, 1974.

*Miller, J. M. and A. E. Belon, A summary of ERTS data application in Alaska, Proceedings of the Ninth International Symposium on Remote Sensing of Environment, Vol. I, 2118-2138, University of Michigan, 1974.

*Miller, J. M., Report to the Alaska Rural Development Council, A Review of Alaskan Resource Surveys Based Upon ERTS Data, 1974.

*McKendrick, Jay D., Report to Alaska Rural Development Council, Mapping Alaskan Vegetation from ERTS-1 Data, 1974.

George, T. H., Survey of the Agricultural Potential of the Tolchaket Region, Report to the City of Nenana Development Council, 1974.

*Stringer, William et al., Application of Remote-Sensing Data to Land Selection and Management Activities - Kaltag Selection Area, Report to Bureau of Indian Affairs and Doyon, Ltd., October 1974.

*Anderson, J. H., Charles H. Racine and Melchior, Preliminary Vegetation Map of the Espenberg Peninsula, Alaska, based upon an Earth Resources Technology Satellite Image, Report to Cooperative Park Studies Unit.

*Reprints available

APPENDIX B

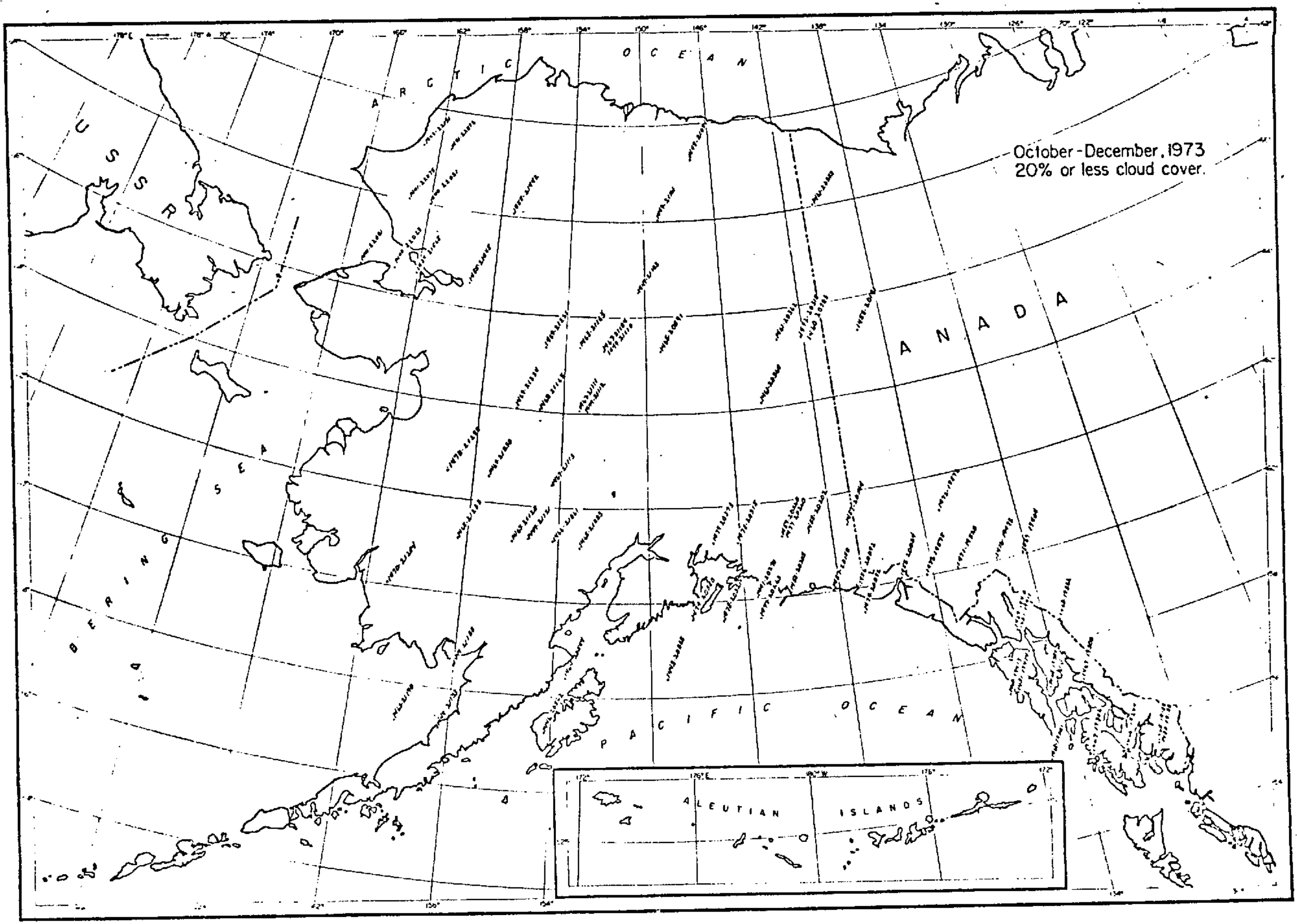
ERTS DATA CATALOG OF ALASKAN SCENES WITH LOW CLOUD COVER

ERTS CATALOG OF ALASKAN SCENES

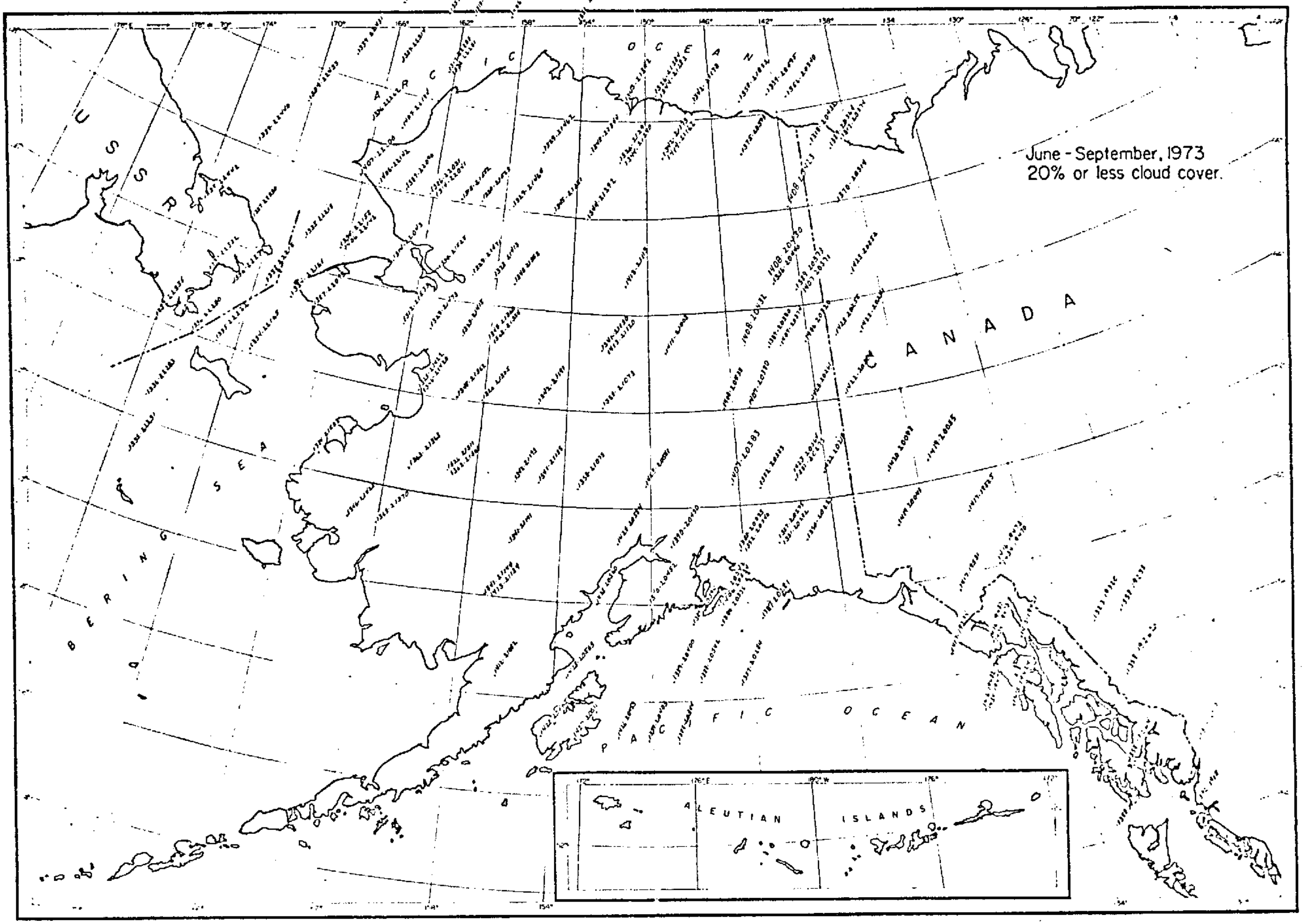
with low cloud cover

July 1972 - November 1974

Prepared by:
ERTS Data Library
Geophysical Institute
University of Alaska

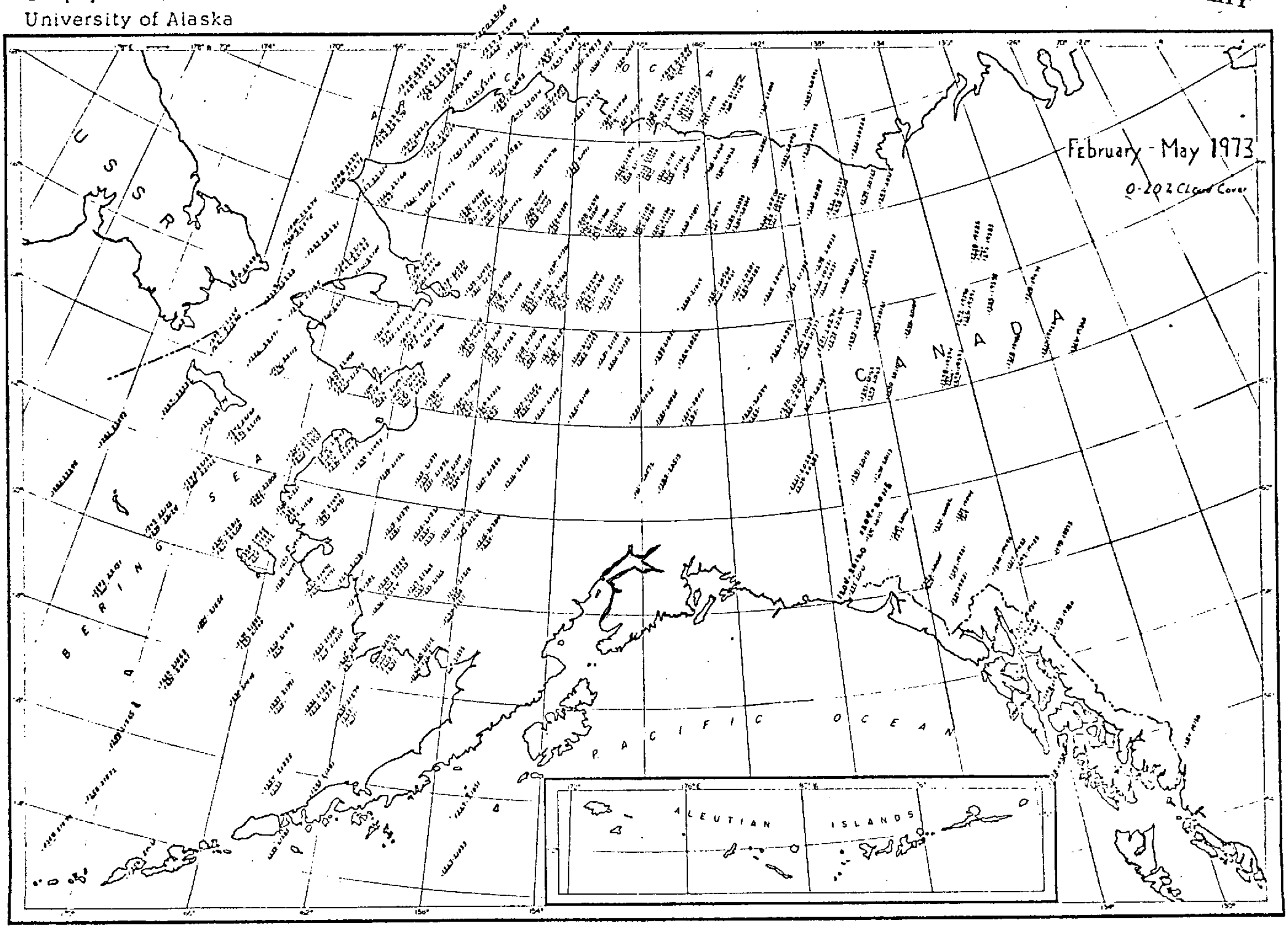


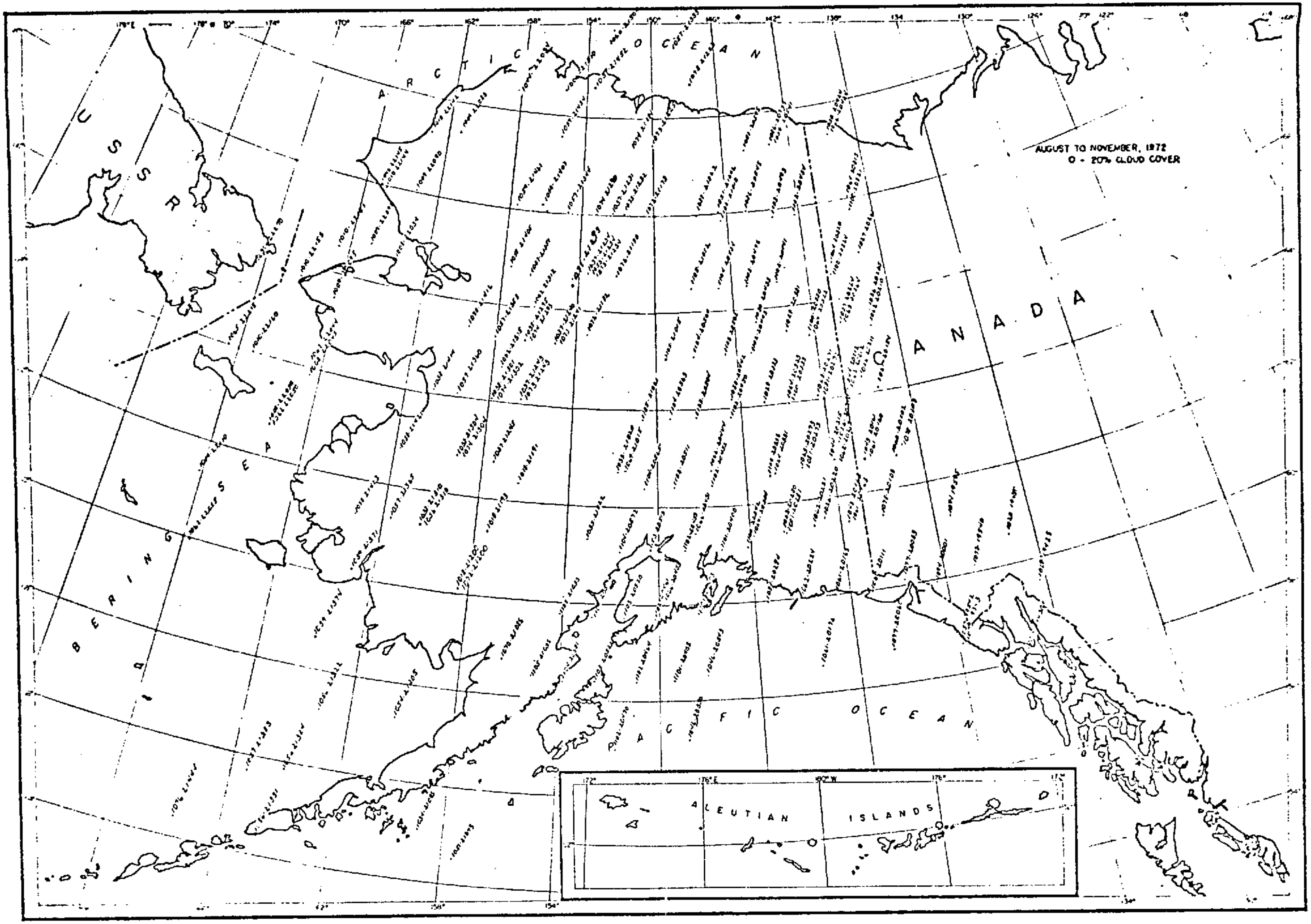
Prepared by:
Geophysical Institute
University of Alaska



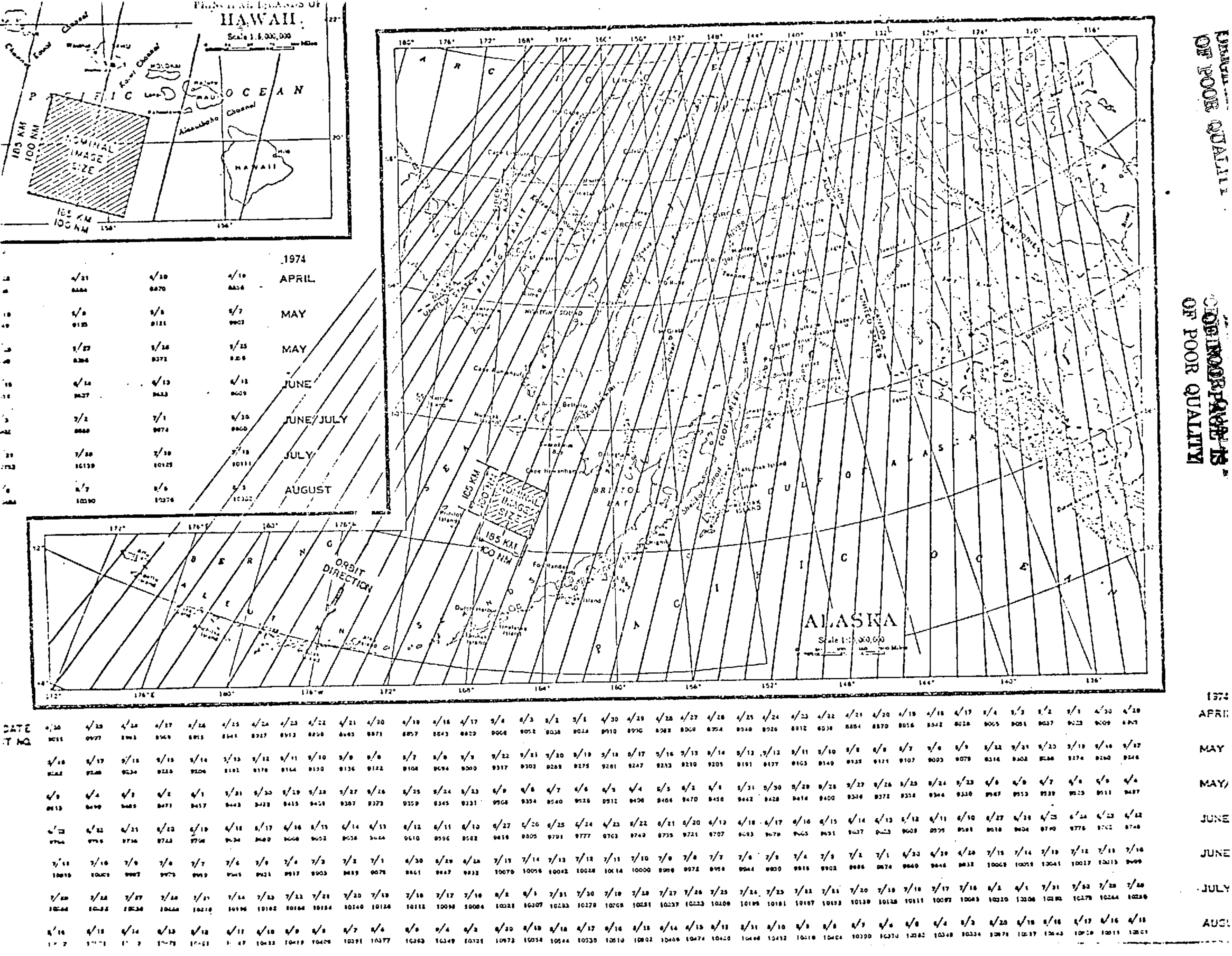
Prepared by:
Geophysical Institute
University of Alaska

Prepared by:
Geophysical Institute
University of Alaska





Prepared by:
Geophysical Institute
University of Alaska



HAWAII
Scale 1:5,000,000
PACIFIC OCEAN
NOMINAL IMAGE SIZE
185 KM
100 NM
1974
APRIL
MAY
MAY
JUNE
JUNE/JULY
JULY
AUGUST
ORBIT DIRECTION
BERING
ALEUTIAN
BRISTOL BAY
GULF OF ALASKA
PACIFIC OCEAN
ARCTIC
ALASKA
DATE
ORBIT NO.
APRIL
MAY
MAY/JUNE
JUNE
JUNE/JULY
JULY
AUGUST

ERTS SCENES WITH LOW CLOUD COVER
JULY - NOVEMBER 1972

Scene ID No.	Date	Cloud Cover	Lat. Center Pt.	Long.	Sun El.	Sun Az.	Map Description	Color = C Digital Tape=D
1002-21310	July 25, 1972	15	67.25N	154.43W	41	162	Walker Lake	D
1002-21312	July 25, 1972	15	66.06N	156.16W	42	160	Hughes	D
1002-21315	July 25, 1972	10	64.45N	157.42W	43	158	Nulato	C + D
1002-21324	July 25, 1972	15	62.02N	160.09W	45	154	Holy Cross	
1006-21510	July 29, 1972	5	60.32N	155.26W	37	168	Barrow	C
1009-22083	August 1, 1972	5	69.25N	161.30W	37	166	Point Lay	
1009-22090	August 1, 1972	2	68.07N	163.21W	39	164	Point Hope	C
1009-22092	August 1, 1972	0	66.48N	165.00W	40	162	Kotzebue	
1009-22095	August 1, 1972	0	65.27N	166.30W	41	160	Seward Peninsula	C + D
1009-22101	August 1, 1972	20	64.07N	167.51W	42	158	Nome	
1009-22110	August 1, 1972	10	61.23N	170.14W	44	154	Bering Sea	
1010-20313	August 2, 1972	10	67.56N	139.29W	39	164	Old Crow	
1010-22133	August 2, 1972	10	71.53N	159.04W	35	171	Sea Ice Off Barrow	
1010-22135	August 2, 1972	0	70.37N	161.21W	36	169	Wainwright, Point Lay	
1010-22142	August 2, 1972	2	69.20N	163.22W	37	166	Point Lay	C
1010-22144	August 2, 1972	2	68.02N	165.09W	38	164	Point Hope	C + D
1010-22145	August 2, 1972	5	67.37N	165.26W	39	163	Point Hope	
1010-22151	August 2, 1972	5	66.42N	166.47W	40	162	Shishmaref	C
1010-22153	August 2, 1972	2	65.21N	168.19W	41	160	Teller	C
1010-22160	August 2, 1972	0	64.01N	169.39W	42	158	St. Lawrence Island	C
1010-22162	August 2, 1972	10	62.39N	170.53W	43	156	St. Lawrence Island	
1016-21045	August 8, 1972	10	71.20N	142.35W	34	171	Arctic Ocean, sea ice	
1018-21191	August 10, 1972	5	62.40N	156.24W	41	157	Iditarod	C + D
1018-21193	August 10, 1972	0	61.19N	157.32W	42	155	Sleetmute	C
1018-21200	August 10, 1972	5	59.57N	158.36W	43	153	Dillingham	C
1019-19423	August 11, 1972	20	59.30N	134.23W	43	153	Atlin	
1019-19430	August 11, 1972	20	58.07N	135.20W	44	151	Juneau	C
1019-21234	August 11, 1972	15	66.24N	153.59W	37	162	Hughes, Bettles	C
1020-19480	August 12, 1972	0	60.32N	135.04W	42	154	Whitehorse	
1026-20211	August 18, 1972	10	64.28N	140.25W	37	160	Eagle	C
1026-20214	August 18, 1972	10	63.06N	141.40W	38	158	Tanacross	C
1026-20220	August 18, 1972	5	61.45N	142.50W	39	156	McCarthy	C
1027-20255	August 19, 1972	10	68.14N	137.29W	33	166	East of Table Mts	
1027-20261	August 19, 1972	20	66.55N	139.08W	34	164	East of BlackRiver	C
1027-22074	August 19, 1972	5	72.26N	156.23W	30	174	Sea Ice north of Barrow	
1028-20324	August 20, 1972	20	64.37N	143.08W	36	160	Eagle	
1029-20365	August 21, 1972	20	69.32N	138.38W	32	168	Herschel Island	
1029-20381	August 21, 1972	2	65.33N	143.38W	35	162	Charlie River	D
1029-20383	August 21, 1972	0	64.12N	145.00W	36	160	Big Delta	C + D
1030-20424	August 22, 1972	20	69.27N	139.54W	31	168	Demarcation Point	C
1030-20430	August 22, 1972	10	68.09N	141.45W	32	166	Table Mountains	C
1030-20433	August 22, 1972	5	66.50N	143.24W	34	164	Black River	C
1030-20435	August 22, 1972	15	65.29N	144.55W	35	162	Circle	
1030-20442	August 22, 1972	10	64.08N	146.17W	36	160	Fairbanks, Delta	C
1030-22270	August 22, 1972	15	65.52N	170.20W	34	162	Chukotsk Penn.,Siberia	C
1030-22273	August 22, 1972	20	64.31N	171.44W	35	161	Siberia, St. Lawrence Is.	
1033-21020	August 25, 1972	20	62.43N	151.52W	36	159	McKinley	C + D
1033-21022	August 25, 1972	10	61.20N	153.01W	37	157	Lime Hills, Tyonek	C
1033-21025	August 25, 1972	10	59.57N	154.04	38	156	Lake Clark, Illiamna	
1034-21095	August 26, 1972	10	55.46N	158.28W	41	151	Stepovak Bay	C
1037-21231	August 29, 1972	5	68.08N	152.01W	30	167	Chandler Lake, Wiseman	C
1037-21234	August 29, 1972	2	66.49N	153.40W	31	165	Hughes, Bettles	C + D
1037-21240	August 29, 1972	5	65.28N	155.09W	32	163	Melozitna	C + D
1037-21243	August 29, 1972	5	64.07N	156.30W	33	161	Nulato, Ruby	C
1037-21245	August 29, 1972	5	62.45N	157.44W	35	159	Ophir, Iditarod	C
1037-21252	August 29, 1972	20	61.23N	158.53W	36	158	Russian Mission, Sleetmute	
1038-21295	August 30, 1972	5	65.29N	156.35W	32	163	Kateel River	C
1038-21301	August 30, 1972	0	64.08N	157.57W	33	161	Nulato	C + D
1038-21304	August 30, 1972	0	62.46N	159.11W	34	160	Holy Cross, Iditarod	C + D
1038-21310	August 30, 1972	20	61.24N	160.19W	35	158	Russian Mission	C + D
1039-21371	August 31, 1972	10	60.00N	162.48W	36	157	Kuskokwim Bay	
1039-21374	August 31, 1972	5	58.37N	163.48W	37	155	Kuskokwim Bay	
1043-20161	September 4, 1972	15	62.42N	140.34W	33	160	Nabesna & east	
1043-20163	September 4, 1972	0	61.19N	141.42W	34	159	McCarthy	C
1044-20201	September 5, 1972	2	68.05N	136.15W	28	167	Aklavik, NWT	
1044-20212	September 5, 1972	2	64.04N	140.44W	31	162	Eagle, Tanacross	C
1044-20215	September 5, 1972	10	62.42N	141.57W	32	161	Tanacross, Nabesna	C
1044-22024	September 5, 1972	0	70.40N	158.09W	25	172.	Meade River	
1045-20255	September 6, 1972	0	68.05N	137.39W	27	168	East of Table Mountains	
1045-22091	September 6, 1972	10	68.05N	163.30W	27	168	Noatak	
1046-20343	September 7, 1972	5	58.31N	148.04W	35	156	Gulf of Alaska	
1046-20350	September 7, 1972	10	57.08N	148.58W	36	155	Pacific Ocean	
1046-22143	September 7, 1972	20	69.20N	163.12W	26	170	Point Lay	

1046-22145	September 7, 1972	10	68.01N	165.02W	27	168	Point Hope	
1047-22201	September 8, 1972	20	69.30N	164.20W	25	170	Point Lay	
1049-20505	September 10, 1972	20	61.24N	150.16W	31	160	Anchorage, Cook Inlet	C + D
1050-20541	September 11, 1972	10	69.28N	142.55W	24	170	Demarcation Point	C
1054-21205	September 15, 1972	10	57.12N	160.22W	33	157	Bristol Bay	
1055-21234	September 16, 1972	0	66.45N	153.39W	25	167	Hughes, Bettles	
1056-21310	September 17, 1972	20	61.20N	160.18W	29	161	Russian Mission	
1056-21324	September 17, 1972	40	55.47N	164.04W	33	156	Cold Bay	
1056-21331	September 17, 1972	20	54.24N	164.52W	35	155	Unimak, False Pass	C
1057=19542	September 18, 1972	0	58.31N	137.59W	31	159	Mt. Fairweather	C
1057-21342	September 18, 1972	20	69.31N	153.05W	22	171	Teshekpuk	
1057-21344	September 18, 1972	0	68.03N	154.55W	23	169	Killik River, Walker Lake	C
1057-21351	September 18, 1972	0	66.44N	156.35W	24	167	Shungnak, Hughes	C
1057-21353	September 18, 1972	0	65.23N	158.04W	25	166	Kateel River, Nulato	C
1057-21360	September 18, 1972	10	64.03N	159.25W	26	164	Norton Bay, Nulato	C
1057-21371	September 18, 1972	5	59.55N	162.49W	30	160	Baird Inlet, Kuskokwim Bay	
1058-21403	September 19, 1972	0	68.09N	156.14W	22	169	Howard Pass, Killik River	C
1058-21405	September 19, 1972	0	66.50N	157.52W	23	168	Shungnak	C
1058-21412	September 19, 1972	0	65.29N	159.22W	25	166	Candle, Kateel	C
1058-21414	September 19, 1972	0	64.08N	160.44W	26	164	Norton Bay, Unalakleet	C
1058-21421	September 19, 1972	0	62.46N	161.48W	27	163	St. Michael, Kwiguk	C
1058-21423	September 19, 1972	0	61.23N	163.07W	28	162	Marshall	C
1059-21445	September 20, 1972	0	72.01N	151.21W	18	176	Arctic Ocean	
1059-21454	September 20, 1972	25	69.28N	155.47W	21	171	Ikpikpuk River	C
1059-21461	September 20, 1972	0	68.10N	157.39W	22	170	Howard Pass	C
1060-20102	September 21, 1972	5	62.44N	139.03W	26	163	Wellesley Lake, Dawson	
1061-20154	September 22, 1972	0	64.04N	139.13W	25	165	Dawson	C
1061-20160	September 22, 1972	0	62 43N	140.28W	26	163	E. of Nabesna	C
1061-20163	September 22, 1972	0	61.21N	141.36W	27	162	McCarthy & East	C
1061-20165	September 22, 1972	0	59.58N	142.39W	28	161	Icy Bay	C
1061-20172	September 22, 1972	10	58.35N	143.38W	29	159	Pacific Ocean	
1062-20210	September 23, 1972	20	65.26N	139.18W	23	166	Charley River	
1062-20212	September 23, 1972	0	64.05N	140.39W	24	165	Eagle	
1062-20215	September 23, 1972	0	62.43N	141.53W	26	163	Nabesna	
1062-20221	September 23, 1972	0	61.21N	143.01W	27	162	McCarthy	C + D
1063-20262	September 24, 1972	20	66.46N	139.16W	22	168	E. of Black River	
1063-20264	September 24, 1972	0	65.26N	140.46W	23	167	Charley River	
1063-20271	September 24, 1972	0	64.04N	142.06W	24	165	Eagle - Tanacross	
1063-20273	September 24, 1972	0	62.42N	143.20W	25	164	Nabesna	
1063-20280	September 24, 1972	0	61.20N	144.28W	26	162	Chitina	C
1063-20282	September 24, 1972	40	59.58N	145.31W	28	161	Valdez, clouds are over ocean	
1064-20331	September 25, 1972	20	62.42N	144.46W	25	164	Gulkana, Nabesna	
1064-20334	September 25, 1972	0	61.19N	145.55W	26	162	Valdez, Cordova	
1066-20424	September 27, 1972	0	69.29N	139.56W	18	172	Demarcation Point	
1066-20444	September 27, 1972	0	62.47N	147.35W	24	164	Mt. Hayes	
1066-20451	September 27, 1972	10	61.25N	148.43W	25	163	Anchorage, cloud over city	D
1066-20453	September 27, 1972	20	60.02N	149.46W	26	162	Seward, Kenai	D
1070-21085	October 1, 1972	0	58.43N	156.24W	26	161	Karluk, Mt. Katmai	
1072-21173	October 3, 1972	5	68.07N	150.26W	17	171	Philip Smith Mountains, Chandalar	C
1072-21180	October 3, 1972	0	66.48N	152.06W	18	169	Bettles, Tanana	C
1072-21182	October 3, 1972	0	65.28N	153.36W	19	168	Tanana, Ruby	C
1072-21200	October 3, 1972	20	60.01N	158.23W	24	162	Taylor Mts., Dillingham	C
1073-21223	October 4, 1972	0	70.46N	147.55W	14	175	Beechey Point	
1073-21225	October 4, 1972	0	69.28N	150.01W	15	173	Umiat, Sagavanirktok	D
1073-21232	October 4, 1972	0	68.09N	151.52W	17	171	Chandler Lake, Wiseman	D
1073-21241	October 4, 1972	20	65.29N	155.00W	19	168	Melozitna, Ruby	
1074-21290	October 5, 1972	0	68.06N	153.18W	16	171	Killik River, Chandler Lake	
1074-21293	October 5, 1972	5	66.48N	154.57W	17	170	Hughes	
1074-21295	October 5, 1972	5	65.28N	156.23W	19	169	Kateel River, Nulato	
1074-21302	October 5, 1972	20	64.07N	157 48W	20	167	Ophir, Nulato	
1075-21345	October 6, 1972	10	68.05N	154.46W	16	171	Killik R., Survey Pass	
1075-21351	October 6, 1972	0	66.46N	156.25W	17	170	Shungnak, Kateel River	
1076-21444	October 7, 1972	0	54.28N	167.42W	27	159	Unalaska, Dutch Harbor	
1077-20033	October 8, 1972	0	66 50N	133.21W	16	170	Canada	
1077-20035	October 8, 1972	10	65.30N	134.52W	17	168	Canada	
1077-20042	October 8, 1972	5	64.09N	136.15W	19	167	Mayo Lake	
1077-20053	October 8, 1972	0	60.03N	139.43W	22	163	Yakutat	C
1077-21453	October 8, 1972	5	70.42N	153.43W	13	175	Teshekpuk, Harrison Bay	D
1078-20085	October 9, 1972	0	68.11N	133.10W	15	172	Sitidgie Lake, Canada	
1078-20091	October 9, 1972	0	66.52N	134.50W	16	170	Canada	
1078-20094	October 9, 1972	0	65.32N	136.20W	17	168	Canada	
1078-20100	October 9, 1972	0	64.10N	137.42W	18	167	Dawson	
1078-20103	October 9, 1972	0	62.49N	138.57W	19	166	Dawson	
1078-20105	October 9, 1972	00	61.27N	140.06W	21	165	Mt. St. Elias	
1078-20112	October 9, 1972	5	60.05N	141.10W	22	163	Icy Bay, Yakutat	
1081-20263	October 12, 1972	5	66.48N	139.13W	15	170	E.of Black River	
1081-20270	October 12, 1972	0	65.28N	140.43W	16	169	E. of Charlie River	

1081-20272	October 12, 1972	0	64.06N	142.04W	17	167	Eagle	
1081-20275	October 12, 1972	0	62.45N	143.19W	18	166	Nabesna	
1081-20281	October 12, 1972	0	61.22N	144.28W	20	165	Cordova, McCarthy	D
1081-20284	October 12, 1972	0	60.00N	145.31W	21	164	Cordova	C
1082-20324	October 13, 1972	0	65.28N	142.06W	16	169	Eagle, Charley River	
1084-19042	October 15, 1972	0	54.22N	127.36W	25	160	Smithers - Canada	
1085-19094	October 16, 1972	0	55.47N	128.15W	23	161	E. of Ketchikan	
1085-19100	October 16, 1972	0	54.23N	129.03W	24	160	Kitimat, S.E.	
1086-19152	October 17, 1972	0	55.45N	129.41W	23	161	Woodcock, S.E.	
1086-20543	October 17, 1972	5	69.20N	143.00W	11	174	Demarcation Point	C
1086-20545	October 17, 1972	5	68.01N	144.50W	12	172	Christian, Table Mountains	D
1087-20595	October 18, 1972	0	70.38N	142.23W	9	176	Barter Island	
1087-21004	October 18, 1972	0	68.03N	146.17W	11	172	Philip Smith Mountains	D
1088-21062	October 19, 1972	0	68.01N	147.47W	11	172	Philip Smith Mountains	D
1088-21071	October 19, 1972	20	65.22N	150.54W	14	169	Tanana, Livengood	
1088-21074	October 19, 1972	20	64.00N	152.15W	15	168	Kantishna River	
1091-19414	October 22, 1972	0	64.00N	138.42W	14	168	Dawson	
1094-19581	October 25, 1972	5	66.37N	132.14W	10	171	Canada	
1094-19583	October 25, 1972	15	65.17N	133.43W	12	169	Canada	
1094-19590	October 25, 1972	0	63.56N	135.05W	13	168	Mayo Lake, Canada	
1094-19595	October 25, 1972	0	61.12N	137.27W	15	166	Kluane Lake, Canada	
1094-20001	October 25, 1972	0	59.50N	138.29W	16	165	Mt. Fairweather	
1096-20112	October 27, 1972	0	61.14N	140.18W	15	166	McCarthy, Mt. St. Elias	
1096=20114	October 27, 1972	0	59.51N	141.20W	16	165	Yakutat	
1100-20315	October 31, 1972	50	69.14N	137.31W	06	174	Herschel Island, land clear	
1100-20324	October 31, 1972	0	66.36N	140.58W	08	171	Black River	C
1100-20330	October 31, 1972	5	65.16N	142.26W	10	170	Charley River	
1100-20342	October 31, 1972	0	61.12N	146.07W	13	166	Valdez	
1101-20403	November 1, 1972	0	59.48N	148.31W	14	165	Blying Sound	C
1102-20434	November 2, 1972	20	67.51N	142.13W	07	173	Coleen	D
1102-20441	November 2, 1972	0	66.31N	143.50W	08	171	Black River, Charlie River	D
1102-20443	November 2, 1972	20	65.11N	145.19W	09	170	Circle	
1102-20450	November 2, 1972	0	63.50N	146.39W	10	168	Mt. Hayes	C
1102-20452	November 2, 1972	0	62.29N	147.52W	11	167	Talkeetna Mtns	C
1102-20455	November 2, 1972	0	61.06N	148.59W	13	166	Anchorage, Cook Inlet	C
1102-20461	November 2, 1972	0	59.44N	150.01W	14	165	Seldovia	C
1102-20464	November 2, 1972	0	58.21N	150.58W	15	164	Pacific Ocean	
1102-20470	November 2, 1972	0	56.59N	151.52W	16	163	Kayuyak	
1103-20493	November 3, 1972	0	67.50N	143.39W	06	173	Coleen, Black River	C + D
1103-20495	November 3, 1972	0	66.31N	145.17W	07	171	Ft. Yukon, Circle	C + D
1103-20502	November 3, 1972	0	65.11N	146.45W	09	170	Fairbanks	C + D
1103-20504	November 3, 1972	0	63.50N	148.05W	10	168	Healy, Talkeetna Mts.	
1103-20511	November 3, 1972	0	62.28N	149.19W	11	167	Talkeetna Mts., Anchorage	D
1103-20513	November 3, 1972	0	61.06N	150.27W	12	166	Anchorage, Cook Inlet	C + D
1103-20520	November 3, 1972	0	59.44N	151.30W	14	165	Kenai Peninsula	C + D
1103-20522	November 3, 1972	0	58.21N	152.28W	15	164	Kodiak, Afognak	C
1104-20554	November 4, 1972	0	66.30N	146.45W	07	171	Fort Yukon	D
1104-20560	November 4, 1972	0	65.10N	148.12W	08	170	Fairbanks	D
1104-20563	November 4, 1972	0	63.49N	149.31W	10	169	McKinley	C
1104-20565	November 4, 1972	0	62.28N	150.44W	11	167	Talkeetna	C + D
1104-20572	November 4, 1972	0	61.06N	151.15W	12	166	Cook Inlet, Tyonek	C + D
1104-21574	November 4, 1972	0	59.44N	152.53W	13	165	Illiamna, Seldovia	C
1105-21010	November 5, 1972	0	67.50N	146.32W	06	173	Christian, Fort Yukon	C + D
1105-21012	November 5, 1972	0	66.30N	148.09W	07	171	Beaver	C
1105-21015	November 5, 1972	0	65.10N	149.38W	08	170	Minto	C
1105-21021	November 5, 1972	0	63.50N	150.50W	09	169	Mt. McKinley	
1105-21033	November 5, 1972	20	59.44N	154.18W	13	165	Illiamna, Mt. Katmai	C
1105-21035	November 5, 1972	20	58.21N	155.16W	14	164	Karluk, Mt. Katmai	C

ERTS SCENES WITH 20% OR LESS CLOUD COVER
1973

Scene I.D.	Date	Cloud Cover	Lat. Center Pt.	Long.	Sun El.	Sun Az.	Map Description	Color = C Digital Tape=D
1198-19373	February 6, 1973	0	60.06N	132.38W	12	158	Atlin	
1198-19380	February 6, 1973	0	58.43N	133.37W	13	157	Juneau	C
1198-19382	February 6, 1973	5	57.19N	134.32W	14	156	Sitka - Sumdum	
1198-19385	February 6, 1973	0	55.56N	135.23W	15	155	Port Alexander	C
1199-19432	February 7, 1973	0	60.03N	134.07W	12	158	Atlin	C
1199-19434	February 7, 1973	0	58.40N	135.06W	13	157	Juneau	C
1199-19441	February 7, 1973	0	57.17N	136.01W	15	156	Sitka	C
1200-19490	February 8, 1973	0	60.00N	135.37W	13	158	Skagway	C
1200-19493	February 8, 1973	2	58.37N	136.35W	14	157	Mt. Fairweather	
1204-20114	February 12, 1973	0	61.23N	140.18W	13	159	East of McCarthy	
1204-20120	February 12, 1973	2	60.00N	141.21W	14	158	Bering Glacier	
1205-21590	February 13, 1973	0	66.51N	162.17W	09	164	Kotzebue	
1205-21592	February 13, 1973	0	65.31N	163.46W	10	162	Bendleben	
1205-21595	February 13, 1973	0	64.10N	165.08W	11	161	Nome - Soloman	
1205-22001	February 13, 1973	5	62.49N	166.23W	12	160	Black	
1205-22004	February 13, 1973	5	61.27N	167.32W	13	159	Hooper Bay	
1211-20501	February 19, 1973	0	66.50N	145.05W	11	164	Fort Yukon	
1211-20504	February 19, 1973	50	65.29N	146.35W	12	162	Livengood-Circle, Top half of scene clear	
1216-21181	February 24, 1973	0	69.27N	148.47W	10	167	Sagavanirktok - Philip Smith Mtns	
1216-21183	February 24, 1973	0	68.08N	150.37W	11	165	Chandler Lake, Philip Smith Mtns.	
1216-21190	February 24, 1973	0	66.49N	152.11W	13	164	Bettles	
1216-21192	February 24, 1973	0	65.29N	153.46W	14	162	Melozitna - Tanana	
1216-21195	February 24, 1973	0	64.08N	155.07W	15	161	Ruby	
1216-21201	February 24, 1973	0	62.47N	156.21W	16	159	Iditarod, McGrath	
1216-21204	February 24, 1973	0	61.25N	157.30W	17	158	Sleetmute	
1216-21210	February 24, 1973	0	60.03N	158.33W	18	157	Taylor Mtns	
1217-21235	February 25, 1973	0	59.26N	150.13W	11	167	Umiat, Sagavanirktok	
1217-21242	February 25, 1973	0	68.08N	152.04W	12	165	Chandler Lake	
1217-21244	February 25, 1973	0	66.48N	153.44W	13	164	Hughes, Bettles	
1217-21251	February 25, 1973	0	65.28N	155.14W	14	162	Melozitna	
1217-21253	February 25, 1973	0	64.07N	156.36W	15	161	Nulato - Ophir	
1217-21260	February 25, 1973	0	62.45N	157.58W	16	159	Iditarod	
1217-21262	February 25, 1973	0	61.24N	158.58W	17	158	Russian Mission - Sleetmute	
1217-21265	February 25, 1973	0	60.01N	160.02W	19	157	Bethel - Taylor Mts.	
1217-21271	February 25, 1973	5	58.39N	161.01W	20	156	Hagemeister Island	
1218-21300	February 26, 1973	0	68.07N	153.33W	12	165	Chandler Lake	
1218-21303	February 26, 1973	15	66.47N	155.13W	13	163	Hughes	
1218-21305	February 26, 1973	0	65.28N	156.42W	14	162	Ka teel River, Melozitna	
1218-21312	February 26, 1973	0	64.07N	158.03W	16	161	Nulato	
1218-21314	February 26, 1973	0	62.45N	159.17W	17	159	Holy Cross, Iditarod	
1218-21321	February 26, 1973	0	61.23N	160.25W	19	158	Russian Mission	
1219-21343	February 27, 1973	5	71.58N	148.47W	09	171	N. of Beechey Point	
1219-21361	February 27, 1973	0	66.47N	156.39W	14	163	Shungnak - Hughes	
1219-21364	February 27, 1973	0	65.26N	158.08W	15	162	Kateel River	
1219-21370	February 27, 1973	0	64.05N	159.29W	16	161	Norton Bay, Nulato	
1219-21373	February 27, 1973	0	62.44N	160.44W	17	159	Holy Cross	
1219-21375	February 27, 1973	0	61.22N	161.52W	18	158	Russian Mission	
1219-21382	February 27, 1973	0	59.59N	162.55W	19	157	Baird Inlet	
1219-21384	February 27, 1973	0	58.36N	163.54W	20	156	Bristol Bay - mostly ice	
1219-21391	February 27, 1973	0	57.14N	164.50W	21	155	Bristol Bay, shows edge of ice	
1220-21413	February 28, 1973	20	68.05N	156.27W	13	165	Howard Pass, Ambler River	
1220-21420	February 28, 1973	0	66.46N	158.05W	14	163	Shungnak	
1220-21422	February 28, 1973	0	65.26N	159.34W	15	162	Candle, Kateel River	
1220-21425	February 28, 1973	0	64.05N	160.55W	16	161	Norton Bay	
1220-21431	February 28, 1973	20	62.44N	162.10W	18	159	Kwiguk	
1220-21434	February 28, 1973	15	61.22N	163.18W	19	158	Marshall	
1220-21440	February 28, 1973	5	59.59N	164.21W	20	157	Baird Inlet, Nunivak Island	
1220-21443	February 28, 1973	25	58.36N	165.20W	21	156	Bristol Bay, sea ice	
1220-21445	February 28, 1973	05	57.13N	166.15W	22	155	Bristol Bay, edge of ice	
1226-20322	March 6, 1973	0	69.29N	137.30W	14	167	Herschel Island	
1226-20324	March 6, 1973	0	68.10N	139.10W	15	165	East of Table Mountains	
1226-20331	March 6, 1973	5	66.50N	140.48W	16	164	East of Black River	
1226-20340	March 6, 1973	5	64.09N	143.39W	19	161	Eagle	
1226-22153	March 6, 1973	0	69.27N	163.11W	14	167	Chukchi Sea off Point Lay	
1226-22160	March 6, 1973	0	68.09N	165.00W	15	165	Point Hope	
1226-22162	March 6, 1973	0	66.50N	166.39W	16	164	Shishmaref	
1226-22165	March 6, 1973	0	65.30N	168 08W	18	162	Seward Peninsula	
1226-22171	March 6, 1973	0	64.09N	169.30W	19	161	St. Lawrence Island	
1226-22174	March 6, 1973	0	62 48N	170 45W	20	159	St. Lawrence Island	
1227-20394	March 7, 1973	10	64.07N	145.10W	19	161	Big Delta, very bottom of image cloudy	D
1227-22203	March 7, 1973	0	72.00N	160.17W	12	172	N. of Wainwright	
1227-22212	March 7, 1973	0	69.27N	164.40W	15	167	Point Lay	
1227-22214	March 7, 1973	0	68.08N	166.31W	16	165	Point Hope	
1227-22221	March 7, 1973	0	66.49N	168.10W	17	164	Bering Straits, Chukchi Sea	
1227-22223	March 7, 1973	0	65.29N	169.39W	18	162	Bering Straits	
1227-22230	March 7, 1973	0	64.08N	171.00W	19	161	St. Lawrence Island	
1227-22232	March 7, 1973	10	62.46N	172.14W	20	159	Bering Sea - Ice	

1228-20435	March 8, 1973	0	69.28N	140.17W	15	167	Herschel Island	
1228-22270	March 8, 1973	0	69.27N	166.02W	15	167	Point Hope	
1228-22273	March 8, 1973	0	68.08N	167.53W	16	165	Point Hope	
1228-22275	March 8, 1973	0	66.49N	169.32W	17	164	Siberia, Chukchi Sea	
1231-21012	March 11, 1973	10	68.07N	146.15W	17	165	Arctic	
1234-21175	March 14, 1973	0	70.38N	146.59W	16	169	Flaxman Island	
1234-21181	March 14, 1973	15	69.21N	149.01W	17	167	Sagavanirktok	
1234-21204	March 14, 1973	2	61.19N	157.39W	24	158	Sleetmute	
1234-21211	March 14, 1973	0	59.57N	158.42W	25	157	Dillingham	
1234-21213	March 14, 1973	10	58.34N	159.40W	26	155	Nushagak Bay	
1235-21233	March 15, 1973	0	70.39N	148.22W	17	169	Beechey Point	
1235-21240	March 15, 1973	0	69.22N	150.25W	18	167	Umiat, Sagavanirktok	
1235-21242	March 15, 1973	2	68.04N	152.14W	19	165	Chandler Lake	
1235-21263	March 15, 1973	20	61.21N	129.04W	25	158	Russian Mission, Sleetmute	
1235-21265	March 15, 1973	3	59.58N	160.06W	26	157	Goodnews	
1235-21272	March 15, 1973	5	58.35N	161.04W	27	155	Hagemeister Island	
1235-21274	March 15, 1973	10	57.12N	161.58W	28	154	Bristol Bay	
1236-21292	March 16, 1973	0	70.39N	149.53W	17	169	Beechey Point	D
1236-21294	March 16, 1973	0	69.21N	151.55W	18	167	Umiat	D
1236-21301	March 16, 1973	0	68.03N	153.44W	19	165	Killik River, Chandler Lake	
1236-21303	March 16, 1973	0	66.44N	155.23W	20	164	Hughes	
1236-21310	March 16, 1973	0	65.23N	156.52W	22	162	Kateel River	
1236-21312	March 16, 1973	0	64.02N	158.12W	23	161	Nulato	
1236-21324	March 16, 1973	0	59.56N	161.36W	26	157	Goodnews	
1236-21330	March 16, 1973	0	58.33N	162.34W	27	155	Hagemeister Island	
1236-21333	March 16, 1973	0	57.11N	163.29W	28	154	Bristol Bay	
1237-19551	March 17, 1973	5	59.59N	137.13W	26	157	Skagway	
1237-19553	March 17, 1973	20	58.36N	138.12W	27	155	Mt. Fairweather	
1237-21344	March 17, 1973	0	71.56N	148.58W	16	172	N. of Beechey Point	
1237-21350	March 17, 1973	0	70.39N	151.15W	17	170	Harrison Bay, Beechey Point	
1237-21353	March 17, 1973	0	69.22N	153.17W	19	167	Ikpikpuk River , Umiat	
1237-21355	March 17, 1973	0	68.04N	155.05W	20	166	Killik River, Survey Pass	
1237-21362	March 17, 1973	5	66.45N	156.43W	21	164	Shungnak	
1237-21373	March 17, 1973	0	62.42N	160.47W	24	159	Holy Cross	
1237-21385	March 17, 1973	0	58.36N	163.57W	27	155	Bristol Bay--ice	
1237-21391	March 17, 1973	0	57.13N	164.51W	29	154	Bristol Bay, edge of ice	
1238-21402	March 18, 1973	0	71.54N	150.26W	17	172	Arctic Ocean, n. of Harrison Bay	
1238-21405	March 18, 1973	0	70.38N	152.45W	18	170	Harrison Bay	
1238-21411	March 18, 1973	0	69.21N	154.48W	19	167	Ikpikpuk River	
1238-21414	March 18, 1973	0	68.02N	156.37W	20	166	Howard Pass, Killik River	
1238-21420	March 18, 1973	0	66.44N	158.18W	21	164	Shungnak	
1238-21423	March 18, 1973	0	65.24N	159.47W	22	162	Candle, Kateel	
1238-21425	March 18, 1973	0	64.02N	161.08W	24	161	Norton Bay	
1238-21432	March 18, 1973	0	62.40N	162.21W	25	159	Kwiguk, Holy Cross	
1238-21434	March 18, 1973	0	61.18N	163.28W	26	158	Marshall	
1238-21441	March 18, 1973	0	59.57N	164.29W	27	156	Nunivak Island	
1238-21443	March 18, 1973	0	58.34N	165.28W	28	155	Bristol Bay	
1239-20061	March 19, 1973	0	61.21N	129.03W	26	158	East of McCarthy	
1239-21461	March 19, 1973	0	71.55N	151.53W	17	172	N. of Teshekpuk	
1239-21463	March 19, 1973	0	70.40N	154.11W	18	170	Teshekpuk	
1239-21470	March 19, 1973	0	69.23N	156.13W	19	168	Lookout Ridge, Ikpikpuk River	
1239-21472	March 19, 1973	0	68.05N	158.03W	21	166	Howard Pass, Ambler River	
1239-21475	March 19, 1973	0	66.45N	159.41W	22	164	Selawik, Shungnak	
1239-21481	March 19, 1973	0	65.25N	161.09W	23	162	Candle	
1239-21484	March 19, 1973	0	64.04N	162.30W	24	161	Solomon, Norton Bay	
1239-21490	March 19, 1973	0	62.43N	163.44W	25	159	Kwiguk	
1239-21493	March 19, 1973	0	61.21N	164.51W	26	158	Marshall	
1239-21495	March 19, 1973	0	59.59N	165.53W	27	157	Cape Mendenhall	
1239-21502	March 19, 1973	0	58.36N	166.51W	28	155	Bristol Bay	
1240-20115	March 20, 1973	0	61.23N	140.27W	26	159	E. of McCarthy	
1240-21515	March 20, 1973	0	71.56N	153.12W	18	172	N. of Teshekpuk	
1240-21531	March 20, 1973	0	68.06N	159.25W	21	166	Misheguk Mtns, Howard Pass	
1240-21533	March 20, 1973	0	66.47N	161.04W	22	164	Selawik	
1240-21540	March 20, 1973	0	65.26N	162.33W	23	162	Bendleben, Candle	
1240-21542	March 20, 1973	0	64.06N	163.53W	24	161	Solomon	
1240-21545	March 20, 1973	0	62.45N	165.07W	25	159	Black, Kwiguk	
1240-21551	March 20, 1973	0	61.22N	166.15W	27	158	dHooper Bay	
1240-21554	March 20, 1973	0	60.00N	167.18W	28	157	Nunivak Island	
1241-20165	March 21, 1973	1	64.06N	139.29W	25	161	E. of Eagle	
1241-20171	March 21, 1973	0	62.45N	140.43W	26	159	E. of Nabesna	
1241-21573	March 21, 1973	0	71.58N	154.38W	18	172	Barrow	
1241-21580	March 21, 1973	0	70.42N	156.57W	19	170	Meade River	
1241-21582	March 21, 1973	0	69.25N	159.00W	20	168	Lookout Ridge, Utukok River	

1241-21585	March 21, 1973	0	68.07N	160.49W	21	166	Misheguk Mtn
1241-21591	March 21, 1973	0	66.48N	162.28W	22	164	Kotzebue, Selawik
1241-21594	March 21, 1973	0	65.28N	163.51W	24	162	Bendleben
1241-22000	March 21, 1973	0	64.07N	165.18W	25	161	Norton Sound, Nome
1241-22003	March 21, 1973	0	62.46N	166.31W	26	159	Black, Bering Sea
1241-22005	March 21, 1973	0	61.24N	167.39W	27	158	Bering Sea, Hooper Bay
1241-22012	March 21, 1973	10	60.02N	168.43W	28	157	Bering Sea, Nunivak Island
1242-20221	March 22, 1973	0	65.25N	139.38W	24	162	E. of Charley River
1242-22032	March 22, 1973	0	71.55N	156.08W	18	172	Barrow
1242-22034	March 22, 1973	0	70.39N	158.26W	19	170	Meade River
1242-22041	March 22, 1973	0	69.22N	160.28W	21	168	Utukok River
1242-22043	March 22, 1973	20	68.04N	162.17W	22	166	Delong Mtns, Misheguk
1243-22090	March 23, 1973	0	71.56N	157.35W	19	172	N. of Barrow
1243-22093	March 23, 1973	0	70.40N	159.52W	20	170	Wainwright, Meade River
1243-22095	March 23, 1973	0	69.24N	161.55W	21	168	Point Lay
1243-22113	March 23, 1973	5	64.66N	168.16W	26	161	Nome
1243-22120	March 23, 1973	10	62.44N	169.30W	27	159	St. Lawrence Island
1243-22125	March 23, 1973	0	60.01N	171.41W	29	157	Bering Sea, ice
1243-22131	March 23, 1973	10	58.38N	172.40W	30	155	Bering Sea, ice
1247-20491	March 27, 1973	5	70.41N	139.47W	21	170	E. of Barter Island
1247-20493	March 27, 1973	0	69.23N	141.50W	23	168	Demarcation Point
1247-20505	March 27, 1973	15	65.26N	146.49W	26	162	Circle
1247-20511	March 27, 1973	25	64.05N	148.09W	27	161	Fairbanks D
1251-21130	March 31, 1973	0	68.09N	149.21W	25	166	Philip Smith Mountains
1251-21132	March 31, 1973	10	66.50N	151.00W	26	164	Bettles
1251-21135	March 31, 1973	0	65.30N	152.30W	28	163	Tanana
1251-21141	March 31, 1973	0	64.10N	153.52W	29	161	Ruby, Kantishna
1252-21175	April 1, 1973	0	70.43N	146.57W	23	170	Flaxman Island
1252-21182	April 1, 1973	0	69.26N	149.01W	25	168	Sagavanirktok
1252-21184	April 1, 1973	20	68.08N	150.51W	26	166	Chandler Lake, Philip Smith Mtns
1252-21191	April 1, 1973	2	66.49N	152.29W	27	164	Bettles
1252-21193	April 1, 1973	2	65.28N	153.59W	28	163	Melozitna, Tanana
1253-21233	April 2, 1973	20	70.43N	148.19W	24	171	Beechey Point
1253-21240	April 2, 1973	20	69.27N	150.21W	25	168	Umiat, Sagavanirktok
1253-21242	April 2, 1973	0	68.09N	152.11W	26	166	Chandler Lake
1253-21245	April 2, 1973	25	66.49N	153.51W	27	164	Hughes, Bettles
1253-21265	April 2, 1973	0	60.04N	160.07W	33	157	Bethel, Goodnews
1253-21272	April 2, 1973	5	58.41N	161.06W	34	155	Hagemeister Island
1253-21274	April 2, 1973	0	57.18N	162.00W	35	154	Bristol Bay
1253-21281	April 2, 1973	10	55.54N	162.52W	36	152	Cold Bay, Port Moller
1253-21283	April 2, 1973	15	54.30N	163.40W	37	151	False Pass
1254-21303	April 3, 1973	0	66.48N	155.25W	28	164	Hughes
1254-21310	April 3, 1973	0	65.28N	156.54W	29	163	Kateel River, Melozitna
1254-21312	April 3, 1973	0	64.07N	158.15W	30	161	Nulato
1254-21315	April 3, 1973	0	62.46N	159.29W	31	159	Holy Cross, Iditarod
1254-21321	April 3, 1973	0	61.24N	160.36W	32	158	Russian Mission
1254-21324	April 3, 1973	0	60.02N	161.39W	33	156	Baird Inlet, Bethel
1255-19551	April 4, 1973	5	60.01N	137.13W	33	156	N. of Skagway
1255-21355	April 4, 1973	0	68.07N	155.12W	27	166	Killik River
1255-21364	April 4, 1973	0	65.28N	158.18W	29	163	Kateel River
1255-21371	April 4, 1973	0	64.08N	159.39W	30	161	Norton Bay, Nulato
1256-21402	April 5, 1973	0	72.00N	150.23W	24	173	N. of Harrison Bay
1256-21405	April 5, 1973	0	70.44N	152.44W	25	171	Harrison Bay
1256-21411	April 5, 1973	0	69.27N	154.48W	26	168	Ikpikpuk River
1256-21414	April 5, 1973	0	68.09N	156.37W	27	166	Howard Pass
1257-21461	April 6, 1973	0	72.01N	151.50W	24	173	N. of Harrison Bay
1258-21515	April 7, 1973	0	72.01N	153.14W	25	173	N. of Teshekpuk
1258-21540	April 7, 1973	10	65.30N	162.35W	30	163	Bendleben, Candle
1258-21542	April 7, 1973	0	64.09N	163.56W	31	161	Solomon
1258-21545	April 7, 1973	0	62.47N	164.59W	32	160	Black, Kwiguk
1258-21551	April 7, 1973	0	61.26N	166.17W	34	158	Hooper Bay
1258-21563	April 7, 1973	60	57.17N	169.14W	37	154	Top cloudy but Pribilof Islands seem clear
1258-21565	April 7, 1973	20	55.54N	170.05W	38	152	Pribilof Islands
1259-21580	April 8, 1973	5	70.45N	156.57W	26	171	Barrow
1259-21582	April 8, 1973	10	69.28N	159.01W	27	169	Utukok River - Lookout Ridge
1259-21585	April 8, 1973	0	68.09N	160.51W	28	167	Misheguk Mtn.
1259-21591	April 8, 1973	2	66.50N	162.30W	29	165	Kotzebue - Selawik
1259-21594	April 8, 1973	0	65.30N	163.59W	31	163	Bendleben
1259-22000	April 8, 1973	5	64.09N	165.20W	32	161	Nome - Soloman
1259-22003	April 8, 1973	20	62.48N	166.35W	33	160	Black
1260-22032	April 9, 1973	0	72.01N	156.04W	25	174	Barrow
1261-20284	April 10, 1973	0	62.48N	143.38W	34	160	Nabesna
1261-22090	April 10, 1973	0	72.01N	157.30W	26	174	N. Of Barrow
1261-22093	April 10, 1973	10	70.45N	159.45W	27	171	Wainwright, Meade River
1261-22102	April 10, 1973	15	68.09N	163.43W	29	167	Delong Mountains

1261-22120	April 10, 1973	10	62.48N	169.25W	34	160	Bering Sea - Ice	
1262-20331	April 11, 1973	0	66.51N	140.59W	31	165	Black River	
1262-20334	April 11, 1973	0	65.31N	142.28W	32	163	Charley River	
1262-20340	April 11, 1973	10	64.10N	143.50W	33	161	Eagle	
1262-22145	April 11, 1973	5	72.02N	159.00W	26	174	N. of Wainwright	
1262-22151	April 11, 1973	5	70.46N	161.19W	27	171	Wainwright	
1262-22154	April 11, 1973	10	69.29N	163.21W	28	169	Point Lay	
1262-22160	April 11, 1973	3	68.11N	165.12W	29	167	DeLong Mountains	
1262-22163	April 11, 1973	5	66.52N	166.51W	31	165	Shishmaref	
1263-20383	April 12, 1973	0	68.10N	140.51W	30	167	Table Mtn	D
1263-20385	April 12, 1973	0	66.50N	142.29W	31	165	Black River	D
1263-20392	April 12, 1973	0	65.30N	143.58W	32	163	Charley River	
1263-20394	April 12, 1973	5	64.09N	145.19W	33	161	Big Delta	D
1263-22203	April 12, 1973	0	72.02N	160.23W	26	174	N. of Wainwright	
1263-22210	April 12, 1973	0	70.46N	162.43W	28	171	Wainwright	
1263-22212	April 12, 1973	0	69.29N	164.46W	29	169	Point Lay	
1264-19051	April 13, 1973	0	54.31N	129.49W	41	151	Canada, SE of Prince Rupert	
1264-20435	April 13, 1973	20	69.28N	140.21W	29	169	Herschel Is.	
1264-20441	April 13, 1973	10	68.11N	142.11S	30	167	Table Mountains	
1264-20444	April 13, 1973	0	66.51N	143.50W	31	165	Black River	
1265-20500	April 14, 1973	0	68.13N	143.38W	30	167	Table Mts.	
1266-20554	April 15, 1973	10	68.13N	145.03W	31	167	Arctic	
1266-20561	April 15, 1973	20	66.54N	146.42W	32	165	Fort Yukon	
1266-20572	April 16, 1973	0	62.52N	150.47W	35	160	Talkeetna Mtn	D
1267-21012	April 16, 1973	5	68.13N	146.27W	31	167	Arctic	D
1267-21051	April 16, 1973	10	55.57N	157.10W	41	152	Sutwik Island	
1268-21064	April 17, 1973	5	69.29N	146.10W	30	169	Mt. Michelson	
1268-21071	April 17, 1973	0	68.11N	147.59W	32	167	Philip Smith Mtns	
1268-21073	April 17, 1973	20	66.51N	149.37W	33	165	Beaver	
1269-21123	April 18, 1973	10	69.29N	147.34W	31	169	Sagavanirktok - Mt. Michelson	
1269-21125	April 18, 1973	0	68.10N	149.24W	32	167	Philip Smith Mtns.	
1269-21132	April 18, 1973	20	66.51N	151.03W	33	165	Bettles	
1269-21155	April 18, 1973	20	58.42N	158.16W	40	155	Nushagak Bay	
1270-21181	April 19, 1973	5	69.29N	149.00W	31	169	Sagavanirktok	
1271-21240	April 20, 1973	10	69.30N	150.25W	31	169	Umiat – Sagavanirktok	
1271-21242	April 20, 1973	0	68.12N	152.15W	33	167	Chandler Lake	
1271-21245	April 20, 1973	0	66.52N	153.54W	34	165	Hughes – Bettles	
1271-21251	April 20, 1973	0	65.32N	155.23W	35	163	Melozitna	
1271-21254	April 20, 1973	0	64.11N	156.44W	36	161	Nulato, Ruby	
1271-21263	April 20, 1973	5	61.28N	159.07W	38	158	Russian Mission - Sleetmute	
1271-21272	April 20, 1973	15	58.42N	161.09W	40	155	Hagemeister Island	
1272-21294	April 21, 1973	15	69.33N	151.47W	32	169	Umiat	
1272-21300	April 21, 1973	5	68.14N	153.38W	33	167	Killik River, Chandler Lake	
1272-21303	April 21, 1973	0	66.55N	155.18W	34	165	Hughes	
1272-21305	April 21, 1973	0	65.35N	156.47W	35	163	Kateel River, Melozitna	
1272-21312	April 21, 1973	0	64.14N	158.09W	36	161	Nulato	
1272-21314	April 21, 1973	0	62.53N	159.24W	37	160	Holy Cross, Iditarod	
1272-21321	April 21, 1973	0	61.31N	160.33W	39	158	Russian Mission	
1272-21323	April 21, 1973	0	60.08N	161.37W	40	156	Bethel	
1272-21330	April 21, 1973	0	58.46N	162.36W	41	155	Kuskokwim Bay - Hagemeister Is.	
1272-21332	April 21, 1973	0	57.22N	163.31W	42	153	Bristol Bay & Ice	
1273-21361	April 22, 1973	10	66.55N	156.44W	34	165	Shungnak - Hughes	
1273=21364	April 22, 1973	0	65.35N	158.14W	36	163	Kateel River	
1273-21370	April 22, 1973	0	64.15N	159.36W	37	161	Norton Bay, Nulato	
1274-20002	April 23, 1973	0	61.31N	137.34W	39	158	N. of Skagway	
1274-20005	April 23, 1973	15	60 09N	138.37W	40	156	Yakutat	
1274-21402	April 23, 1973	5	72.06N	150.16W	30	174	N. of Harrison Bay	
1274-21420	April 23, 1973	10	66.56N	158.10W	35	165	Shungnak	
1274-21422	April 23, 1973	0	65.36N	159.40W	36	163	Candle, Kateel R.	
1274-21425	April 23, 1973	0	64.15N	161.02W	37	161	Norton Bay	
1275-20061	April 24, 1973	[illegible]	61.31N	139.01W	40	158	North of Mt. St. Elias	
1275-20063	April 24, 1973	20	60.09N	140.04W	41	156	Mt. St. Elias	
1275-21483	April 24, 1973	0	64.14N	162.28W	37	161	Norton Bay	
1276-21542	April 25, 1973	0	64.14N	163.53W	38	161	Soloman	
1276-21544	April 25, 1973	0	62.53N	165.08W	39	160	Black - Kwiguk	
1276-21551	April 25, 1973	0	61.30N	166.16W	40	158	Hooper Bay	
1276-21553	April 25, 1973	10	60.08N	167.20W	41	156	Nunivak Island	
1277-21584	April 26, 1973	0	68.18N	160.48W	35	167	Misheguk Mtns	
1277-22000	April 26, 1973	0	64.18N	165.19W	38	161	Nome, Soloman	
1277-22002	April 26, 1973	0	62.56N	166.34W	39	160	Black	
1277-22005	April 26, 1973	10	61.34N	167.42W	40	158	Hooper Bay	
1277-22011	April 26, 1973	0	60.11N	168.45W	41	156	Bering Sea	
1279-20265	April 28, 1973	5	68.19N	137.46W	35	167	East of Table Mts	
1279-20272	April 28, 1973	15	67.00N	139.26W	36	165	East of Coleen	
1279-20274	April 28, 1973	15	65.40N	140.56W	37	163	Charley River	
1279-20281	April 28, 1973	0	64.19N	142.18W	39	161	Eagle	

1279-22090	April 28, 1973	0	72.11N	157.18W	32	175	Barrow	
1279-22092	April 28, 1973	5	70.55N	159.39W	33	172	Wainwright, Meade River	
1279-22113	April 28, 1973	5	64.19N	168.10W	39	161	Bering Sea - Ice	
1279-22115	April 28, 1973	10	62.58N	169.25W	40	160	St. Lawrence Island - Ice	
1280-20330	April 29, 1973	20	66.59N	140.51W	37	165	East of Black River	
1280-20333	April 29, 1973	0	65.39N	142.21W	38	163	Charlie River	
1280-20335	April 29, 1973	0	64.18N	143.43W	39	161	Delta - Eagle	
1283-20495	May 2, 1973	0	68.16N	143.35W	36	167	Table Mtn	
1283-20502	May 2, 1973	0	66.58N	145.14W	28	165	Ft. Yukon	
1283-20504	May 2, 1973	5	65.37N	146.44W	39	163	Circle	
1283-20513	May 2, 1973	15	62.55N	149.22W	41	159	Talkeetna Mtns	
1284-20551	May 3, 1973	10	69.34N	143.12W	36	170	Demarcation Point	
1284-20553	May 3, 1973	0	68.15N	145.02W	37	167	Arctic	
1284-20560	May 3, 1973	0	66.56N	156.41W	38	165	Ft. Yukon	
1284=20562	May 3, 1973	0	65.35N	148.11W	39	163	Livengood	
1284-20565	May 3, 1973	0	64.15N	159.33W	40	161	McKinley	
1284-20571	May 3, 1973	25	62.53N	150.47W	41.	159	Talkeetna	
1285-21014	May 4, 1973	20	66.59N	148.02W	38	165	Beaver	
1285-21021	May 4, 1973	5	65.39N	149.32W	39	163	Livengood	
1285-21023	May 4, 1973	3	64.18N	150.54W	40	161	Kantishna River	
1288-21210	May 7, 1973	3	60.12N	158.42W	45	156	Taylor Mtns	
1288-21212	May 7, 1973	1	58.49N	159.41W	46	154	Hagemeister Island, Nushagak Bay	
1291-21363	May 10,1973	5	65.35N	158.15W	41	163	Kateel River	
1291-21370	May 10, 1973	5	64.14N	159.38W	42	161	Norton Bay, Nulato	
1291-21372	May 10, 1973	5	62.52N	160.53W	43	159	Kwiguk, Holy Cross	
1291-21375	May 10, 1973	5	61.30N	162.02W	44	157	Marshall, Russian Mission	
1291-21381	May 10, 1973	10	60.07N	163.05W	45	155	Kuskokwim	
1293-21482	May 12, 1973	15	64.15N	162.27W	43	161	Norton Bay	
1293-21491	May 12, 1973	10	61.32N	164.50W	45	157	Marshall	
1293-21494	May 12, 1973	10	60.10N	165.53W	46	155	Nunivak Island	
1293-21500	May 12, 1973	10	58.47N	166.51W	47	153	Bering Sea	
1294-20121	May 13, 1973	10	60.08N	141.31W	46	155	Icy Bay	
1294-21541	May 13, 1973	0	64.14N	163.56W	43	161	Soloman	
1294-21543	May 13, 1973	10	62.53N	165.10W	44	159	Black	
1294-21550	May 13, 1973	0	61.31N	166.18W	45	157	Hooper Bay	
1294-21552	May 13, 1973	0	60.08N	167.21W	46	155	Nunivak Island	
1295-20161	May 14, 1973	0	65.38N	138.11W	42	163	East of Charley River	
1295-20163	May 14, 1973	0	64.17N	139.33W	43	161	East of Eagle	
1295-21572	May 14, 1973	0	72.09N	154.34W	36	175	North of Teshekpuk	
1295-21575	May 14, 1973	5	70.53N	156.55W	37	172	Meade River	
1295-21581	May 14, 1973	5	69.35N	158.59W	38	169	Ututok River, Lookout Ridge	
1295-21584	May 14, 1973	15	68.17N	160.50W	40	167	Misheguk Mtn	
1298-20323	May 17, 1973	0	68.19N	139.15W	40	167	East of Table Mtn.	
1298-20325	May 17, 1973	2	67.00N	140.55W	41	165	Coleen, Black River	
1299-22224	May 18, 1973	2	64.18N	171.03W	44	161	Siberia, Bering Straits	
1300-20460	May 19, 1973	25	61.35N	149.01W	46	157	Anchorage	C + D
1300-22262	May 19, 1973	0	70.56N	164.02W	38	172	Point Lay	
1300-22265	May 19, 1973	0	69.39N	166.07W	40	169	Point Hope	
1300-22271	May 19, 1973	5	68.28N	167.58W	41	67	Point Hope	
1300-22274	May 19, 1973	20	67.01N	169.37W	42	165	Chukchi Sea	
1300-22280	May 19, 1973	15	65.41N	171.07W	43	163	Chukotsch Penn.	
1304-21063	May 23, 1973	2	69.36N	146.04W	40	169	Mt. Michelson	C
1305-21115	May 24, 1973	5	70.52N	145.31W	39	172	Flaxman Is.	
1305-21121	May 24, 1973	20	69.35N	147.35W	41	169	Sagavanirktok, Mt. Michelson	
1305-21133	May 24, 1973	0	65.36N	152.36W	44	162	Tanana	
1307-19434	May 26, 1973	0	58.46N	135.17W	50	152	Juneau	C
1307-21231	May 26, 1973	3	70.53N	148.15W	40	172	Beechey Point	D
1308-21290	May 27, 1973	0	70.55N	149.37W	40	172	Beechey Point	D
1308-21292	May 27, 1973	0	69.38N	151.41W	41	169	Umiat	D
1308-21295	May 27, 1973	5	68.20N	153.32W	42	167	Killik River, Chandler	
1308-21301	May 27, 1973	5	67.00N	155.12W	43	164	Survey Pass, Hughes	
1308-21310	May 27, 1973	15	64.19N	158.05W	46	160	Nulato	
1308-21313	May 27, 1973	20	62.57N	159.21W	47	158	Holy Cross, Iditarod	
1311-21472	May 30, 1973	0	66.57N	159.41W	44	164	Selawik, Shungnak	C
1311-21475	May 30, 1973	20	65.36N	161.10W	45	162	Selawik	C
1311-21481	May 30, 1973	0	64.15N	162.30W	46	160	Soloman, Norton Bay	C
1312-20113	May 31, 1973	20	61.32N	140.28W	48	156	McCarthy & East	C
1312-21524	May 31, 1973	0	68.18N	159.24W	43	166	Misheguk Mtn, Howard Pass	
1312-21531	May 31, 1973	0	66.58N	161.04W	44	164	Misheguk Mtn	C
1312-21533	May 31, 1973	20	65.37N	162.34W	45	162	Bendelben, Candle	C
1313-21582	June 1, 1973	0	68.16N	160.54W	43	166	Misheguk Mtn	C
1313-21585	June 1, 1973	5	66.57N	162.33W	44	164	Kotzebue	C
1314-22041	June 2, 1973	5	68.18N	162.17W	43	166	DeLong Mtn, Misheguk	C

1314-22043	June 2, 1973	0	66.59N	163.55W	44	164	Kotzebue	C
1317-20374	June 5, 1973	0	69.38N	138.56W	42	168	Canada, Herschel Island	
1317-22203	June 5, 1973	0	70.55N	162.38W	41	171	Wainwright	
1318-20432	June 6, 1973	20	69.38N	140.20W	42	168	Herschel Island	
1323-19320	June 11, 1973	15	58.49N	132.26W	51	150	Taku River	C
1326-21284	June 14, 1973	0	70.50N	149.51W	42	170	Beechey Point	C + D
1326-21291	June 14, 1973	5	69.32N	151.55W	43	168	Umiat	D
1326-21305	June 14, 1973	5	64.12N	158.14W	47	158	Nulato	C
1326-21311	June 14, 1973	5	62.50N	159.28W	48	156	Holy Cross	C
1328-20004	June 16, 1973	20	58.42N	139.38W	52	150	Yakutat	
1328-21413	June 16, 1973	5	66.54N	158.15W	45	163	Shungnak	
1328-21415	June 16, 1973	1	65.33N	159.44W	46	160	Candle - Kateel	
1328-21422	June 16, 1973	0	64.12N	161.05W	47	158	Norton Bay	
1329-21455	June 17, 1973	20	70.51N	154.04W	42	170	Teshekpuk	C
1329-21462	June 17, 1973	3	69.33N	156.08W	43	167	Lookout Ridge	C
1329-21464	June 17, 1973	3	68.15N	157.57W	44	165	Howard Pass	C
1329-21471	June 17, 1973	0	66.55N	159.36W	45	163	Selawik	C
1329-21473	June 17, 1973	10	65.35N	161.06W	46	160	Candle	C
1330-21523	June 18, 1973	5	68.13N	159.32W	44	165	Misheguk Mtn, Howard Pass	C
1330-21525	June 18, 1973	0	66.52N	161.13W	45	162	Selawik	C
1334-22155	June 22, 1973	5	66.54N	166.52W	45	162	Shishmaref	C
1334-22161	June 22, 1973	0	65.34N	168.22W	46	160	Teller	C
1334-22164	June 22, 1973	0	64.13N	169.44W	47	158	St. Lawrence	C
1335-22201	June 23, 1973	10	70.51N	162.45W	42	170	Wainwright	
1335-22215	June 23, 1973	2	65.34N	169.48W	46	160	Teller, Little & Big Diomede	C
1335-22222	June 23, 1973	2	64.13N	171.09W	47	158	St. Lawrence Island	
1335-22224	June 23, 1973	0	62.51N	172.23W	48	155	St. Lawrence Island	C
1335-22231	Jnne 23, 1973	5	61.30N	173.31W	50	153	St. Matthews	
1336-20440	June 24, 1973	10	66.51N	143.56W	45	162	Black River	C
1336-22262	June 24, 1973	15	69.29N	166.17W	43	187	Point Hope	
1336-22274	June 24, 1973	1	65.30N	171.13W	46	160	Siberia	
1336-22280	June 24, 1973	0	64.09N	172.34W	47	157	Siberia, St. Lawrence	
1337-22330	June 25, 1973	0	66.54N	171.10W	45	162	Siberia	
1337-22332	June 25, 1973	0	65.34N	172.40W	46	160	Siberia	
1337-22335	June 25, 1973	0	64.12N	174.02W	47	157	Siberia	

1339-20595	June 27, 1973	20	70.50N	142.43W	42	169	Barter Island	
1339-22424	June 27, 1973	0	72.06N	166.07W	41	172	Chukchi Sea	
1339-22431	June 27, 1973	0	70.51N	168.27W	42	169	Chukchi Sea	
1339-22433	June 27, 1973	0	69.33N	170.32W	43	167	Chukchi Sea	
1339-22440	June 27, 1973	0	68.15N	172.22W	44	164	Chukchi Sea	
1339-22442	June 27, 1973	0	66.55N	174.01	45	162	Siberia	
1341-21130	June 29, 1973	10	65.33N	152.39W	46	159	Tanana	C
1341-21135	June 29, 1973	20	62.49N	155.14W	48	155	McGrath	C
1341-21141	June 29, 1973	5	61.28N	156.23W	49	153	Sleetmute, Lime Hills	C
1341-21144	June 29, 1973	5	60.03N	157.05W	50	151	Taylor Mts.	
1342-21170	June 30, 1973	15	70.49N	147.01W	42	196	Beechey Pt., Flaxman Is.	
1342-21173	June 30, 1973	15	69.31N	149.04W	43	166	Sagavanirktok	C + D
1342-21191	June 30, 1973	10	64.11N	155.23W	47	157	Ruby	C
1342-21193	June 30, 1973	20	62.49N	156.37W	48	155	Iditarod, McGrath	C
1344-21283	July 2, 1973	0	70.49N	149.53W	42	169	Beechey Point	C + D
1344-21290	July 2, 1973	2	69.31N	151.57W	43	166	Umiat	C
1344-21292	July 2, 1973	0	68.12N	153.47W	44	164	Chandler Lake	C
1345-21342	July 3, 1973	5	70.44N	151.30W	41	169	Harrison Bay	C
1345-21344	July 3, 1973	20	69.27N	153.33W	43	166	Ikpikpuk River	C
1345-21351	July 3, 1973	10	68.08N	155.22W	44	164	Killik River	C
1345-21353	July 3, 1973	10	66.48N	157.00W	45	161	Shungnak	C
1345-21360	July 3, 1973	15	65.28N	158.28W	46	159	Kateel River	C
1345-21362	July 3, 1973	10	64.07N	159.48W	47	157	Norton Bay, Nulato	C
1346-21420	July 4, 1973	20	64.07N	161.10W	47	157	Norton Bay	
1346-21425	July 4, 1973	20	61.24N	163.31W	49	153	Marshall	C
1349-21564	July 7, 1973	0	71.59N	154.54W	40	172	Barrow	
1350-20223	July 8, 1973	2	61.24N	143.26W	48	153	McCarthy	
1351-20275	July 9, 1973	10	62.41N	143.48W	47	155	Nabesna	D
1351-20282	July 9, 1973	5	61.19N	144.56W	48	152	Valdez, McCarthy	C + D
1352-20333	July 10, 1973	5	62.44N	145.14W	47	155	Gulkana	C + D
1352-20340	July 10, 1973	10	61.22N	146.21W	48	153	Valdez	
1352-20342	July 10, 1973	15	60.00N	147.23W	49	150	Seward, Cordova	
1354-22275	July 12, 1973	20	64.08N	172.39W	46	157	Siberia, St. Lawrence Island	
1356-20540	July 14, 1973	0	70.44N	141.22W	40	168	Barter Island	
1358-19262	July 16, 1973	2	57.14N	131.58W	50	147	East of Sumdum	
1358-19264	July 16, 1973	0	55.51N	132.49W	51	145	Craig, Ketchikan	C
1358-19271	July 16, 1973	0	54.27N	133.37W	52	142	Dixon Entrance	C
1358-21052	July 16, 1973	20	70.44N	144.18W	40	168	Flaxman Island	

1358-21073	July 16, 1973	20	64.07N	152.32W	45	157	Kantishna River	C
1358-21075	July 16, 1973	2	62.46N	153.45W	46	155	McGrath	C
1358-21082	July 16, 1973	20	61.24N	154.53W	47	153	Lime Hills	C
1362-21305	July 20, 1973	5	62.43N	159.34W	46	155	Holy Cross, Iditarod	C
1363-21354	July 21, 1973	0	65.25N	158.32W	43	159	Kateel River	C
1363-21363	July 21, 1973	0	62.43N	161.04W	45	155	Holy Cross	C
1363-21370	July 21, 1973	15	61.20N	162.10W	46	153	Russian Mission	C
1365-20051	July 23, 1973	20	61.21N	139.07W	46	153	Burwash Landing	C
1370-20314	July 28, 1973	10	68.07N	139.35W	40	163	E. of Table Mtn	C
1374-19150	August 1, 1973	0	55.47N	129.59W	48	146	East of Ketchikan	C
1375-20595	August 2, 1973	10	69.24N	144.57W	37	166	Flaxman Island	C + D
1375-21002	August 2, 1973	15	68.05N	146.46W	38	164	Arctic	C + D
1384-21533	August 11, 1973	5	62.39N	165.14W	40	156	Black, Kwiguk	
1386-22031	August 13, 1973	15	68.03N	162.32W	35	164	DeLong Mts.	
1387-20275	August 14, 1973	15	61.20N	144.54W	41	155	Valdez	D
1387-20281	August 14, 1973	0	59.58N	145.56W	42	153	Cordova, Middleton Is.	C + D
1387-20284	August 14, 1973	0	58.35N	146.54W	43	152	Gulf of Alaska	
1387-22090	August 14, 1973	5	68.04N	163.58W	35	165	DeLong Mt.	C
1387-22095	August 14, 1973	20	65.22N	167.05W	37	160	Teller	C
1388-20333	August 15, 1973	2	61.20N	146.18W	40	155	Valdez	C + D
1388-20335	August 15, 1973	3	59.58N	147.20W	41	153	Blying Sound	D
1388-20342	August 15, 1973	0	58.35N	148.18W	42	152	Gulf of Alaska	
1389-20364	August 16, 1973	15	69.23N	139.06W	33	167	Herschel Is.	
1389-20373	August 16, 1973	10	66.45N	142.32W	36	163	Black River	C
1389-20380	August 16, 1973	20	65.25N	144.00W	37	161	Circle	
1389-20394	August 16, 1973	5	59.59N	148.45W	41	154	Seward	D
1390-20450	August 17, 1973	10	61.22N	149.09W	40	156	Anchorage	C + D
1390-20452	August 17, 1973	0	60.00N	150.12W	41	154	Kenai	C + D
1392-19145	August 19, 1973	5	55.49N	129.59W	43	149	East of Ketchikan	C
1392-19151	August 19, 1973	0	54.24N	130.46W	44	148	SE, Prince Rupert	C
1396-21162	August 23, 1973	20	70.41N	147.08W	30	170	Beechey Pt., Flaxman Island	D + C
1396-21165	August 23, 1973	20	69.24N	149.09W	31	168	Sagavanirktok	C
1406-20320	September 2, 1973	10	65.29N	142.29W	31	163	Charley River	C
1406-20334	September 2, 1973	3	60.01N	147.15W	35	157	Seward, Cordova	
1406-20340	September 2, 1973	10	58.38N	148.14W	36	155	Gulf of Alaska	
1406-22131	September 2, 1973	5	72.02N	159.04W	25	174	Arctic Ocean	
1406-22142	September 2, 1973	20	68.09N	165.14W	29	167	Point Hope	
1406-22145	September 2, 1973	5	66.50N	166.53W	30	165	Shishmaref	
1407-20371	September 3, 1973	20	66.49N	142.28W	29	165	Black River	C + D
1407-20374	September 3, 1973	2	65.28N	143.57W	31	163	Charley River	C
1407-20380	September 3, 1973	15	64.07N	145.17W	32	161	Delta	C
1407-20383	September 3, 1973	20	62.46N	146.31W	33	160	Gulkana	C + D
1407-22191	September 3, 1973	60	70.44N	162.44W	26	171	Wainwright, clds over water, land clear	C
1407-22194	September 3, 1973	15	69.27N	164.46W	29	169	Point Lay	
1407-22200	Sept. 3, 1973	20	68.08N	166.35W	28	167	Point Hope, clds over water, land clear	C
1408-20423	Sept. 4, 1973	15	68.08N	142.12W	28	167	Table Mt.	C
1408-20430	Sept. 4, 1973	0	66.49N	143.51W	29	165	Black River	C + D
1408-20432	Sept. 4, 1973	20	65.29N	145.20W	30	163	Circle	C
1408-20435	Sept. 4, 1973	5	64.07N	146.42W	31	162	Fairbanks - Delta	C + D
1411-21003	Sept. 7, 1973	5	65.28N	149.37W	29	164	Livengood	C + D
1412-21082	Sept. 8, 1973	10	58.38N	156.47W	34	156	Naknek	
1413-21113	Sept. 9, 1973	20	66.49N	151.02W	27	166	Bettles	C + D
1413-21120	Sept. 9, 1973	20	65.29N	152.31W	28	164	Tanana	C + D
1413-21134	Sept. 9, 1973	5	60.02N	157.18W	33	158	Taylor Mts. - Lake Clark	C
1414-21162	Sept. 10, 1973	15	69.28N	149.00W	25	170	Sagavanirktok	
1415-19421	Sept. 11, 1973	20	58.37N	135.15W	33	157	Juneau	
1415-19424	Sept. 11, 1973	0	57.13N	136.10W	35	156	Sitka	
1416-19473	Sept. 12, 1973	0	60.01N	135.49W	32	158	Skagway	C
1416-19480	Sept. 12, 1973	0	58.36N	136.47W	33	157	Mt. Fairweather	
1416-19482	Sept. 12, 1973	5	57.11N	137.41W	34	156	Sitka, Gulf of Alaska	
1417-19525	Sept. 13, 1973	0	61.22N	136.08W	30	160	Canada, Lake LeBarge, etc.	
1417-19531	Sept. 13, 1973	0	59.59N	137.11W	32	159	Skagway	
1417-19534	Sept. 13, 1973	0	58.37N	138.09W	33	157	Mt. Fairweather	
1419-20035	Sept. 15, 1973	0	62.44N	137.54W	29	162	Canada, E. of Tanacross	
1419-20041	Sept. 15, 1973	0	61.21N	139.01W	30	160	Mt. St. Elias	C
1420-20093	Sept. 16, 1973	1	62.47N	139.17W	28	162	E. of Nabesna	C
1422-20201	Sept. 18, 1973	0	65.33N	139.33W	25	165	E. of Charley River	
1422-20203	Sept. 18, 1973	0	64.12N	140.55W	26	164	Eagle	C
1422-20210	Sept. 18, 1973	0	62.51N	142.09W	27	162	Nabesna	C
1422-20212	Sept. 18, 1973	0	61.28N	143.17W	29	161	McCarthy	C + D
1422-20215	Sept. 18, 1973	20	60.05N	144.19W	30	160	Cordova, Bering Glacier, land clear	C
1423-20252	Sept. 19, 1973	5	66.55N	139.21W	23	167	E. of Black River	
1423-20255	Sept. 19, 1973	0	65.34N	140.51W	25	166	Charley River	D
1423-20261	Sept. 19, 1973	5	64.13N	142.13W	26	164	Eagle	D
1423-20264	Sept. 19, 1973	20	62.51N	143.28W	27	162	Nabesna	
1423-20270	Sept. 19, 1973	5	61.29N	144.37W	28	161	Valdez, McCarthy	
1424-20340	Sept. 20, 1973	2	57.21N	148.55W	31	157	Gulf of Alaska	
1426-20453	Sept. 22, 1973	20	57.18N	151.50W	30	158	Kodiak	
1427-20511	Sept. 23, 1973	10	57.20N	153.19W	30	158	Karluk, Kodiak	
1428-20551	Sept. 24, 1973	20	62.50N	150.38W	25	163	Talkeetna	
1428-20554	Sept. 24, 1973	2	61.27N	151.47W	26	162	Tyonek	C D

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1428-20560	Sept. 24, 1973	0	60.05N	152.50W	27	161	Kenai	
1428-20563	Sept. 24, 1973	0	58.42N	153.50W	29	159	Mt. Katmai, Afognak	
1428-20565	Sept. 28, 1973	4	57.19N	154.45W	30	158	Karluk, Kodiak	
1432-21160	Sept. 28, 1973	0	69.30N	148.44W	18	172	Sagavanirktok	D
1434-19470	Sept. 30, 1973	0	60.04N	135.36W	25	162	Skagway	C
1434-19473	Sept. 30, 1973	10	58.41N	136.35W	26	160	Mt. Fairweather	C
1434-19475	Sept. 30, 1973	10	57.18N	137.30W	28	159	Sitka	
1439-21565	Oct. 5, 1973	3	66.52N	162.18W	17	169	Kotzebue, Selawik	
1440-22021	Oct. 6, 1973	0	68.10N	162.06W	16	171	DeLong Mt.	
1440-22023	Oct. 6, 1973	5	66.50N	163.46W	17	169	Kotzebue	
1441-20270	Oct. 7, 1973	20	60.01N	145.40W	23	162	Cordova	
1441-22072	Oct. 7, 1973	10	69.26N	161.44W	14	173	Utukok River	
1441-22075	Oct. 7, 1973	0	68.07N	163.33W	15	171	DeLong Mt.	
1441-22081	Oct. 7, 1973	10	66.48N	165.11W	17	169	Kotzebue, Shishmaref	
1442-20310	Oct. 8, 1973	5	65.30N	142.16W	17	168	Charley River	
1442-22131	Oct. 8, 1973	20	69.28N	163.12W	14	173	Point Lay	
1443-20385	Oct. 9, 1973	5	58.44N	149.25W	23	162	Tip of Seldovia	
1446-20562	Oct. 12, 1973	20	57.21N	154.35W	23	161	Karluk	
1449-21094	Oct. 15, 1973	20	69.34N	147.03W	11	173	Mt. Michelson	
1449-21101	Oct. 15, 1973	0	68.15N	149.02W	12	172	Phillip Smith Mt.	
1449-21103	Oct. 15, 1973	10	66.56N	150.41W	14	170	Wiseman	
1449-21110	Oct. 15, 1973	10	65.36N	152.12W	15	168	Tanana	
1449-21112	Oct. 15, 1973	5	64.15N	153.34W	16	167	Ruby, Kantishna	
1449-21121	Oct. 15, 1973	20	61.32N	155.58W	18	165	Lime Hills	
1449-21130	Oct. 15, 1973	20	58.46N	158.01W	21	162	Dillingham	
1449-21133	Oct. 15, 1973	10	57.22N	158.55W	22	161	Ugashik	
1449-21135	Oct. 15, 1973	60	55.58N	159.46W	23	160	Chignik, crater clear	
1451-19411	Oct. 17, 1973	15	58.45N	135.02W	20	163	Juneau	
1451-19414	Oct. 17, 1973	5	57.21N	135.57W	21	162	Sitka	
1455-20034	Oct. 21, 1973	20	60.07N	139.46W	18	164	Yakutat	
1455-20040	Oct. 21, 1973	5	58.44N	140.45W	19	163	Gulf of Alaska	
1455-21442	Oct. 21, 1973	1	68.13N	157.36W	10	172	Howard Pass	
1455-21445	Oct. 21, 1973	20	66.54N	159.16W	11	170	Selawik	
1456-20092	Oct. 22, 1973	5	60.08N	141.13W	17	164	Bering Glacier	
1457-20144	Oct. 23, 1973	0	61.28N	141.34W	16	165	McCarthy	
1457-20150	Oct. 23, 1973	0	60.06N	142.37W	17	164	Bering Glacier	
1458-20191	Oct. 24, 1973	0	65.33N	139.15W	12	169	E. of Charley River	
1458-20202	Oct. 24, 1973	0	61.28N	143.01W	15	165	McCarthy	
1458-20205	Oct. 24, 1973	15	60.06N	144.05W	17	164	Cordova	
1459-20260	Oct. 25, 1973	20	61.28N	144.27W	15	165	Valdez, McCarthy	
1460-20303	Oct. 26, 1973	1	65.30N	142.13W	11	169	Charley River	
1461-20353	Oct. 27, 1973	10	68.11N	140.30W	08	172	Table Mt.	
1461-20362	Oct. 27, 1973	10	65.30N	143.38W	11	169	Charley River	
1461-20364	Oct. 27, 1973	15	64.09N	144.59W	12	168	Big Delta	D
1464-20554	Oct. 30, 1973	2	58.39N	153.43W	16	164	Afognak	
1465-19185	Oct. 31, 1973	15	55.53N	131.05W	18	162	Ketchikan	
1465-20591	Oct. 31, 1973	20	65.30N	149.21W	09	169	Livengood, Fairbanks	
1465-21003	Oct. 31, 1973	10	61.26N	153.07W	13	166	Lime Hills	
1466-19244	Nov. 1, 1973	10	55.54N	132.30W	18	162	Craig	
1466-21061	Nov. 1, 1973	15	61.26N	154.32W	13	166	Lake Clark	
1466-21064	Nov. 1, 1973	10	60.04N	155.35W	14	165	Lake Clark	
1467-19300	Nov. 2, 1973	0	57.14N	133.08W	16	163	Sumdum	
1467-19302	Nov. 2, 1973	0	55.51N	133.58W	17	162	Craig	
1467-21104	Nov. 2, 1973	5	65.28N	152.16W	09	169	Tanana	
1467-21111	Nov. 2, 1973	0	64.08N	153.37W	10	168	Ruby, Kantishna R.	
1467-21113	Nov. 2, 1973	20	62.46N	154.52W	20	167	McGrath	
1467-21120	Nov. 2, 1973	5	61.24N	156W	12	166	Sleetmute, Lime Hills	
1468-19352	Nov. 3, 1973	5	58.38N	133.41W	15	164	Taku River	
1468-19354	Nov. 3, 1973	0	57.15N	134.35W	16	163	Sitka	
1468-19361	Nov. 3, 1973	0	55.49N	135.20W	17	162	Sitka	
1468-21163	Nov. 3, 1973	0	65.30N	153.46W	08	169	Melozitna	
1468-21165	Nov. 3, 1973	10	64.09N	155.07W	10	168	Medfra	
1468-21190	Nov. 3, 1973	10	57.16N	160.26W	16	161	Chignik	
1469-19404	Nov. 4, 1973	10	60.02N	134.09W	13	165	Carcross	
1469-19410	Nov. 4, 1973	15	58.39N	135.07W	14	164	Juneau	
1469-19413	Nov. 4, 1973	0	57.15N	136.00W	15	163	Sitka	
1469-21221	Nov. 4, 1973	0	65.29N	155.08W	08	169	Melozitna	
1469-21224	Nov. 4, 1973	5	64.08N	156.30W	09	168	Nulato - Ophir	
1469-21230	Nov. 4, 1973	5	62.47N	157.45W	11	167	Iditarod	
1469-21233	Nov. 4, 1973	20	61.25N	158.55W	12	166	Sleetmute	
1470-21285	Nov. 5, 1973	10	62.46N	159.09W	10	167	Iditarod	
1470-21294	Nov. 5, 1973	3	60.02N	161.22W	13	165	Bethel	
1471-19520	Nov. 6, 1973	0	60.03N	137.00W	12	165	Skagway	
1472-19572	Nov. 7, 1973	0	61.23N	137.25W	11	166	Haines Junction	
1472-19575	Nov. 7, 1973	0	60.00N	138.27W	12	165	Yakutat	
1474-20092	Nov. 9, 1973	0	59.58N	141.19W	12	165	Bering Glacier, Icy Bay	
1477-20260	Nov. 12, 1973	0	61.20N	144.34W	10	166	McCarthy	
1477-20263	Nov. 12, 1973	0	59.58N	145.38W	11	165	Cordova	
1477-20265	Nov. 12, 1973	0	58.35N	146.36W	12	164	Gulf of Alaska	
1478-20315	Nov. 13, 1973	0	61.19N	146.03W	09	166	Valdez	
1478-20321	Nov. 13, 1973	10	59.57N	147.06W	11	165	Blying Sound	D
1479-20373	Nov. 14, 1973	0	61.19N	147.31W	09	166	Valdez, Anchorage	
1479-20380	Nov. 14, 1973	5	59.56N	148.34W	10	165	Blying Sound	
1483-19185	Nov. 18, 1973	20	55.43N	131.13W	13	162	Ketchikan	

ERTS SCENES WITH LOW CLOUD COVER - 1974

1535-19062	January 9, 1974	0	55.45N	128.22W	09	158	East of Ketchikan
1555-19171	January 29, 1974	10	55.55N	131.07W	13	155	Ketchikan
1555-19173	January 29, 1974	10	54.31N	131.55W	14	154	Prince Rupert
1555-20591	January 29, 1974	0	60.04N	154.12W	10	158	Illamna
1555-20593	January 29, 1974	0	58.41N	155.11W	11	157	Mt. Katmai
1556-19222	January 30, 1974	0	57.20N	131.41W	12	156	East of Sumdum
1556-19225	January 30, 1974	3	55.57N	132.32W	13	155	Craig
1560-21274	February 3, 1974	10	60.07N	161.16W	11	157	Bethel
1560-21280	February 3, 1974	20	58.44N	162.15W	12	156	Hagemeister Island
1565-21525	February 8, 1974	0	70.54N	156.31W	03	168	Barrow
1565-21532	February 8, 1974	5	69.37N	158.37W	04	166	Lookout Ridge
1565-21534	February 8, 1974	20	68.18N	160.29W	06	164	Misheguk Mt.
1565-21541	February 8, 1974	10	66.59N	162.07W	07	163	Selawik - Noatak
1565-21543	February 8, 1974	5	65.39N	163.38W	08	162	Bendeleben
1565-21550	February 8, 1974	0	64.18N	164.59W	09	160	Nome - Solomon
1565-21552	February 8, 1974	5	62.57N	166.14W	10	159	Black
1565-21555	February 8, 1974	20	61.35N	167.23W	11	158	Hooper Bay
1566-21593	February 9, 1974	20	68.17N	161.54W	06	164	Misheguk Mt.
1566-21595	February 9, 1974	0	66.58N	163.33W	07	163	Noatak - Kotzebue
1566-22002	February 9, 1974	10	65.37N	165.03W	08	161	Bendleben
1567-22051	February 10, 1974	5	68.18N	163.18W	06	164	DeLong Mt.
1567-22053	February 10, 1974	20	66.59N	164.59W	07	163	Kotzebue
1567-22060	February 10, 1974	0	65.39N	166.29W	08	161	Teller
1567-22062	February 10, 1974	0	64.18N	167.51W	10	160	Nome
1567-22065	February 10, 1974	3	62.56N	169.06W	11	159	St. Lawrence Is.
1568-22123	February 11, 1974	0	62.55N	170.35W	11	159	St. Lawrence Is.
1573-20580	February 16, 1974	10	62.51N	151.59W	13	159	Mt. McKinley - Talkeetna
1573-20582	February 16, 1974	2	61.29N	153.01W	14	157	Lime Hills - Tyonek
1574-21031	February 17, 1974	0	64.15N	152.10W	12	160	Kantishna River
1574-21034	February 17, 1974	5	62.54N	153.25W	13	158	McGrath
1574-21040	February 17, 1974	0	61.32N	154.34W	14	157	Lime Hills
1574-21043	February 17, 1974	2	60.09N	155.36W	15	156	Lake Clark
1575-21090	February 18, 1974	0	64.12N	153.37W	12	160	Kantishna River
1575-21092	February 18, 1974	0	62.50N	154.52W	13	158	McGrath
1575-21095	February 18, 1974	0	61.28N	156.00W	15	157	Sleetmute - Lime Hills
1575-21101	February 18, 1974	0	60 06N	157.04W	16	156	Taylor Mts.
1575-21104	February 18, 1974	0	58.43N	158.02W	17	155	Nushagak Bay
1576-21135	February 19, 1974	0	66.56N	152.10W	10	162	Bettles
1576-21142	February 19, 1974	0	65.35N	153.39W	12	161	Melozitna
1576-21144	February 19, 1974	0	64.14N	154.59W	13	160	Ruby
1576-21151	February 19, 1974	0	62.52N	156.14W	14	158	Iditarod - McGrath
1576-21153	February 19, 1974	0	61.31N	157.23W	15	157	Sleetmute
1576-21160	February 19, 1974	0	60.08N	158.27W	16	156	Taylor Mts.
1576-21162	February 19, 1974	5	58.46N	159.27W	17	155	Nushagak Bay
1577-21191	February 20, 1974	0	68.16N	151.54W	10	164	Chandler Lake
1577-21193	February 20, 1974	0	66.57N	153.34W	11	162	Hughes
1577-21200	February 20, 1974	0	65.36N	155.05W	12	161	Melozitna
1577-21202	February 20, 1974	0	64.15N	156.27W	13	160	Nulato - Ruby
1577-21205	February 20, 1974	0	62.53N	157.41W	14	158	Ophir - Iditarod
1577-21211	February 20, 1974	0	61.31N	158.50W	15	157	Sleetmute
1577-21214	February 20, 1974	2	60.09N	159.53W	16	156	Taylor Mts.
1577-21220	February 20, 1974	5	58.46N	160.52W	17	155	Hagemeister Island
1578-21245	February 21, 1974	0	68.17N	153.18W	10	164	Killik River
1578-21252	February 21, 1974	0	66.58N	154.58W	11	162	Hughes
1578-21254	February 21, 1974	0	65.38N	156.29W	12	161	Kateel River
1578-21261	February 21, 1974	0	64.17N	157.51W	13	160	Nulato
1578-21263	February 21, 1974	0	62.55N	159.06W	14	158	Iditarod
1578-21270	February 21, 1974	0	61.33N	160.15W	16	157	Russian Mission
1578-21272	February 21, 1974	0	60.11N	161.19W	17	156	Bethel
1578-21275	February 21, 1974	0	58.48N	162.18W	18	155	Hagemeister Island
1578-21281	February 21, 1974	0	57.24N	163.13W	19	154	Bering Strait
1579-21304	February 22, 1974	0	68.16N	154.48W	10	164	Killik River
1579-21310	February 22, 1974	0	66.56N	156.27W	12	162	Shungnak
1579-21313	February 22, 1974	10	65.36N	157.57W	13	161	Kateel River
1579-21315	February 22, 1974	0	64.15N	159.19W	14	160	Norton Bay - Nulato
1579-21322	February 22, 1974	5	62.53N	160.34W	15	158	Holy Cross
1579-21324	February 22, 1974	20	61.31N	161.43W	16	157	Russian Mission
1579-21331	February 22, 1974	25	60.08N	162.47W	17	156	Baird Inlet
1580-21362	February 23, 1974	0	68.16N	156.05W	11	164	Howard Pass - Killik River
1580-21364	February 23, 1974	0	66.57N	157.46W	12	162	Shungnak
1580-21371	February 23, 1974	0	65.37N	159.17W	13	161	Candle - Kateel River
1580-21373	February 23, 1974	0	64.16N	160.40W	14	160	Norton Bay
1580-21380	February 23, 1974	0	62.55N	161.56W	15	158	Unalakleet
1580-21382	February 23, 1974	0	61.33N	163.06W	16	157	Marshall
1580-21385	February 23, 1974	5	60.10N	164.09W	17	156	Baird Inlet
1581-21420	February 24, 1974	0	68.17N	157.33W	11	164	Howard Pass
1581-21423	February 24, 1974	0	66.58N	159.13W	12	162	Selawik
1581-21425	February 24, 1974	0	65.38N	160.44W	13	161	Candle
1581-21432	February 24, 1974	0	64.17N	162.06W	14	160	Norton Bay
1581-21434	February 24, 1974	5	62.56N	163.21W	16	158	Kwiguk

1581-21443	February 24, 1974	10	60.11N	165.36W	18	156	Nunivak Island
1581-21450	February 24, 1974	0	58.49N	166.36W	19	155	Bering Sea
1582-21474	February 25, 1974	0	68.18N	158.55W	12	164	Howard Pass
1582-21481	February 25, 1974	0	67.00N	160.30W	13	162	Baird Mts.
1582-21483	February 25, 1974	0	65.40N	162.00W	14	161	Bendeleben - Candle
1582-21490	February 25, 1974	0	64.19N	163.32W	15	160	Solomon
1582-21492	February 25, 1974	0	62.57N	164.49W	16	158	Kwiguk
1583-20122	February 26, 1974	20	61.32N	141.40W	17	157	McCarthy
1583-20124	February 26, 1974	0	60.10N	142.43W	18	156	Bering Glacier
1583-21521	February 26, 1974	0	72.07N	154.12W	09	170	Arctic Ocean
1583-21524	February 26, 1974	0	70.51N	156.33W	10	168	Wainwright
1583-21530	February 26, 1974	0	69.34N	158.38W	11	166	Lookout Ridge
1583-21533	February 26, 1974	10	68.16N	160.29W	12	164	Misheguk Mtn.
1583-21553	February 26, 1974	5	61.31N	167.28W	17	157	Hooper Bay
1584-20165	February 27, 1974	15	65.37N	139.16W	14	161	East of Charley River
1584-20174	February 27, 1974	2	62.54N	141.52W	17	158	Nabesna
1584-20180	February 27, 1974	10	61.32N	143.02W	18	157	McCarthy
1584-22005	February 27, 1974	10	62.54N	167.40W	17	158	St. Lawrence Island
1586-20275	March 1, 1974	0	66.58N	140.38W	14	162	Black River
1586-20281	March 1, 1974	0	65.37N	142.09W	15	161	Charley River
1586-20284	March 1, 1974	0	64.16N	143.32W	16	159	Eagle
1586-20290	March 1, 1974	0	62.55N	144.47W	17	158	Gulkana
1586-20293	March 1, 1974	0	61.33N	145.56W	18	157	Valdez
1586-20295	March 1, 1974	2	60.10N	147.00	20	156	Seward
1586-22095	March 1, 1974	0	70.51N	160.48W	11	168	Wainwright
1586-22101	March 1, 1974	0	69.34N	162.53W	12	166	Point Lay
1586-22104	March 1, 1974	0	68.16N	164.44W	13	164	Point Hope
1586-22110	March 1, 1974	0	66.46N	166.25W	14	162	Shishmaref
1586-22113	March 1, 1974	5	65.36N	167.55W	15	161	Teller
1586-22115	March 1, 1974	15	64.15N	169.17W	16	159	Bering Straits
1587-20330	March 2, 1974	0	68.17N	140.24W	13	164	East of Table Mts.
1587-20333	March 2, 1974	0	66.57N	142.04W	15	162	Black River
1587-20335	March 2, 1974	0	65.37N	143.35W	16	161	Charley River
1587-22153	March 2, 1974	0	70.52N	162.17W	11	168	Wainwright
1587-22160	March 2, 1974	0	69.35N	164.22W	12	166	Point Lay
1587-22162	March 2, 1974	0	68.17N	166.14W	13	164	Point Hope
1589-22281	March 4, 1974	5	66.57N	170.42W	15	162	Chukotsch Peninsula
1590-20493	March 5, 1974	0	70.47N	140.54W	12	168	Arctic Ocean
1590-20495	March 5, 1974	0	69.30N	142.59W	14	166	Demarcation Point
1590-20502	March 5, 1974	0	68.12N	144.51W	15	164	Arctic
1590-20504	March 5, 1974	0	66.52N	146.30W	16	162	Fort Yukon
1590-20511	March 5, 1974	0	65.32N	148.00W	17	161	Livengood - Fairbanks
1590-20522	March 5, 1974	20	61.27N	151.45W	20	157	Tyonek
1591-19160	March 6, 1974	5	57.19N	130.18W	24	153	Bradfield Canal
1592-19212	March 7, 1974	0	58.44N	130.50W	23	154	East of Taku River
1592-19215	March 7, 1974	0	57.20N	131.45W	24	153	East of Sumdum
1592-19221	March 7, 1974	0	55.57N	132.36W	25	152	Craig
1592-21005	March 7, 1974	0	70.48N	143.44W	13	168	Barter Island
1592-21012	March 7, 1974	0	69.31N	145.49W	14	166	Mt. Michelson
1592-21014	March 7, 1974	0	68.12N	147.40W	15	164	Philip Smith Mtns
1592-21021	March 7, 1974	5	66.53N	149.20W	17	162	Beaver
1592-21023	March 7, 1974	0	65.33N	150.50W	18	161	Tanana, Livengood
1592-21030	March 7, 1974	0	64.12N	152.13W	19	159	Kantishna River
1592-21032	March 7, 1974	15	62.50N	153.28W	20	158	McGrath
1593-19270	March 8, 1974	0	58.43N	132.16W	23	154	Taku River
1593-21063	March 8, 1974	20	70.49N	145.15W	14	168	Flaxman Island
1593-21075	March 8, 1974	0	66.54N	150.49W	17	162	Bettles
1593-21081	March 8, 1974	0	65.34N	152.19W	18	161	Tanana
1593-21084	March 8, 1974	0	64.13N	153.41N	19	159	Ruby - Kantishna River
1593-21090	March 8, 1974	0	62.51N	154.56W	20	158	McGrath
1593-21093	March 8, 1974	0	61.29N	156.04W	21	157	Sleetmute - Lime Hills
1593-21095	March 8, 1974	15	60.06N	157.06W	22	155	Taylor Mts.
1594-21122	March 9, 1974	0	70.49N	146.36W	14	168	Flaxman Island
1594-21124	March 9, 1974	0	69.32N	148.41W	15	166	Sagavanirktok
1594-21131	March 9, 1974	0	68.13N	150.33W	16	164	Chandler Lake
1594-21133	March 9, 1974	0	66.53N	152.13W	17	162	Bettles
1594-21140	March 9, 1974	0	65.33N	153.43W	18	161	Melozitna
1594-21142	March 9, 1974	0	64.13N	155.04W	19	159	Ruby
1594-21145	March 9, 1974	0	62.51N	156.18W	21	158	Iditarod
1594-21151	March 9, 1974	0	61.29N	157.27W	22	157	Sleetmute
1594-21154	March 9, 1974	0	60.06N	158.30W	23	155	Taylor Mts
1594-21160	March 9, 1974	0	58.43N	159.29W	24	154	Nushagak Bay
1594-21163	March 9, 1974	0	57.20N	160.24W	25	153	Bristol Bay
1594-21172	March 9, 1974	20	54.33N	162.04W	27	151	False Pass
1595-21180	March 10, 1974	2	70.50N	148.05W	14	168	Beechey Point
1595-21183	March 10, 1974	0	69.33N	150.10W	15	166	Sagavanirktok
1595-21185	March 10, 1974	0	68.14N	152.00W	17	164	Chandler Lake
1595-21192	March 10, 1974	0	66.54N	153.40W	18	162	Hughes
1595-21194	March 10, 1974	0	65.34N	155.10W	19	161	Melozitna
1595-21201	March 10, 1974	0	64.13N	156.31W	20	159	Nulato
1595-21203	March 10, 1974	0	62.52N	157.46W	21	158	Iditarod

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1595-21210	March 10, 1974	0	61.30N	158.55W	22	157	Sleetmute
1595-21212	March 10, 1974	0	60.07N	159.50W	23	155	Taylor Mts.
1595-21215	March 10, 1974	0	58.44N	160.57W	24	154	Hagemeister Island
1595-21221	March 10, 1974	0	57.21N	161.52W	25	153	Bristol Bay
1596-21234	March 11, 1974	0	70.46N	149.29W	15	168	Beechey Point
1596-21241	March 11, 1974	5	69.29N	151.33W	16	166	Umiat
1596-21243	March 11, 1974	0	68.10N	153.24W	17	164	Chandler Lake
1596-21250	March 11, 1974	0	66.51N	155.03W	18	162	Hughes
1596-21252	March 11, 1974	0	65.31N	156.34W	19	161	Melozitna
1596-21255	March 11, 1974	0	64.10N	157.55W	20	159	Nulato
1596-21261	March 11, 1974	0	62.49N	159.11W	21	158	Holy Cross
1597-19493	March 12, 1974	0	60.05N	137.02W	24	155	North of Skagway
1597-19500	March 12, 1974	0	58.42N	138.01W	25	154	Mt. Fairweather
1597-21304	March 12, 1974	10	66.55N	156.31W	18	162	Shungnak
1597-21325	March 12, 1974	0	60.08N	162.50W	24	155	Bethel
1598-19551	March 13, 1974	0	60.07N	138.30W	24	155	Yakutat
1598-19554	March 13, 1974	0	58.44N	139.29W	25	154	Yakutat & ocean, land clear
1599-20003	March 14, 1974	0	61.29N	138.50W	24	156	East of McCarthy
1599-21414	March 14, 1974	5	68.15N	157.43W	18	164	Howard Pass
1599-21421	March 14, 1974	0	66.56N	159.23W	19	162	Shungnak
1599-21423	March 14, 1974	0	65.36N	160.53W	20	161	Candle
1599-21430	March 14, 1974	0	64.15N	162.14W	21	159	Solomon
1599-21432	March 14, 1974	0	62.53N	163.29W	23	158	Kwiguk
1599-21435	March 14, 1974	0	61.31N	164.38W	24	157	Marshall
1599-21441	March 14, 1974	0	60.08N	165.41W	25	155	Nunivak Island
1600-20055	March 15, 1974	0	62.52N	139.11W	23	158	East of Nabesna
1600-20062	March 15, 1974	0	61.30N	140.20W	24	156	East of McCarthy
1600-20064	March 15, 1974	0	60.07N	141.23W	25	155	Bering Glacier
1600-20071	March 15, 1974	5	58.45N	142.21W	26	154	Pacific Ocean
1600-21461	March 15, 1974	5	72.07N	152.54W	15	171	Arctic Ocean
1600-21464	March 15, 1974	5	70.51N	155.15W	16	168	Barrow
1600-21473	March 15, 1974	0	68.16N	159.11W	19	164	Misheguk Mt.
1600-21475	March 15, 1974	0	66.56N	160.51W	20	162	Selawik
1600-21482	March 15, 1974	5	65.36N	162.21W	21	161	Bendeleben
1600-21484	March 15, 1974	0	64.15N	163.42W	22	159	Solomon
1600-21491	March 15, 1974	0	62.54N	164.57W	23	158	Kwiguk
1601-20111	March 16, 1974	0	64.15N	139.17W	22	159	East of Eagle
1601-20113	March 16, 1974	0	62.53N	140.32W	23	158	East of Nabesna
1601-20120	March 16, 1974	0	61.31N	141.41W	24	157	McCarthy
1601-20122	March 16, 1974	0	60.09N	142.45W	25	155	Bering Glacier
1601-21515	March 16, 1974	10	72.07N	154.17W	16	171	Arctic Ocean
1601-21522	March 16, 1974	0	70.51N	156.38W	17	168	Barrow
1601-21524	March 16, 1974	0	69.34N	158.43W	18	166	Lookout Ridge
1601-21531	March 16, 1974	0	68.16N	160.36W	19	164	Misheguk Mt.
1601-21533	March 16, 1974	0	66.56N	162.16W	20	162	Noatak
1601-21540	March 16, 1974	0	65.36N	163.46W	21	161	Bendeleben
1601-21542	March 16, 1974	2	64.16N	165.08W	22	159	Nome
1602-21574	March 17, 1974	0	72.08N	155.50W	16	171	Barrow
1602-21580	March 17, 1974	0	70.52N	158.10W	17	168	Meade River
1602-21583	March 17, 1974	0	69.35N	160.15W	18	166	Utukok River
1602-21585	March 17, 1974	0	68.16N	162.05W	19	164	DeLong Mt.
1603-20223	March 18, 1974	25	64.15N	142.10W	23	159	Eagle
1603-20232	March 18, 1974	20	61.31N	144.34W	25	156	Valdez
1603-22032	March 18, 1974	0	72.07N	157.08W	16	171	Arctic Ocean
1603-22034	March 18, 1974	0	70.51N	159.34W	18	168	Wainwright
1603-22041	March 18, 1974	0	69.33N	161.39W	19	166	Utukok River
1603-22043	March 18, 1974	2	68.15N	163.29W	20	164	Delong Mt.
1604-20270	March 19, 1974	20	68.08N	139.14W	20	164	East of Table Mt.
1604-20275	March 19, 1974	20	65.28N	142.22W	22	161	Charley River
1604-22090	March 19, 1974	0	72.00N	158.50W	17	171	Barrow
1604-22093	March 19, 1974	0	70.44N	161.09W	18	168	Wainwright
1604-22095	March 19, 1974	0	69.27N	163.14W	19	166	Point Lay
1604-22102	March 19, 1974	0	68.09N	165.05W	20	164	Point Hope
1604-22104	March 19, 1974	15	66.49N	166.44W	21	162	Shishmaref
1605-22145	March 20, 1974	0	71.59N	160.14W	17	171	Arctic Ocean
1605-22151	March 20, 1974	0	70.43N	162.34W	18	168	Wainwright
1605-22154	March 20, 1974	0	69.26N	164.38W	20	166	Point Lay
1605-22160	March 20, 1974	10	68.07N	166.28W	21	164	Point Hope
1606-18592	March 21, 1974	0	54.27N	127.44W	32	150	East of Prince Rupert
1606-20360	March 21, 1974	0	69.25N	140.17W	20	166	Herschel Island
1606-22203	March 21, 1974	20	71.58N	161.42W	18	171	N. of Wainwright
1607-20432	March 22, 1974	20	70.43N	139.43W	19	168	Arctic Ocean
1607-20435	March 22, 1974	20	69.25N	141.45W	20	166	Demarcation Point
1607-20453	March 22, 1974	0	64.06N	148.02W	25	159	Fairbanks
1608-20491	March 23, 1974	5	70.43N	141.09W	20	168	Arctic Ocean
1608-20493	March 23, 1974	0	69.26N	143.12W	21	166	Barter Island
1609-20545	March 24, 1974	0	70.43N	142.38W	20	168	Barter Island
1609-20551	March 24, 1974	0	69.25N	144.40W	21	166	Mt. Michelson
1609-20554	March 24, 1974	1	68.07N	146.29W	22	164	Arctic
1609-20560	March 24, 1974	20	66.47N	148.07W	23	162	Beaver
1610-21003	March 25, 1974	0	70.43N	144.04W	20	168	Barter Island
1610-21010	March 25, 1974	0	69.25N	146.07W	22	166	Mt. Michelson

1610-21012	March 25, 1974	0	68.07N	147.56W	23	164	Phillip Smith Mtns.
1610-21015	March 25, 1974	0	66.47N	149.35W	24	162	Beaver
1610-21021	March 25, 1974	0	65.27N	151.04W	25	161	Tanana - Livengood
1610-21024	March 25, 1974	0	64.06N	152.24W	26	159	Kantishna River
1611-21064	March 26, 1974	5	69.25N	147.25W	22	166	Sagavanirktok
1611-21070	March 26, 1974	0	68.06N	149.24W	23	164	Phillip Smith Mts.
1611-21073	March 26, 1974	0	66.47N	151.02W	24	162	Bettles
1611-21075	March 26, 1974	0	65.27N	152.31W	25	161	Tanana
1611-21082	March 26, 1974	5	64.06N	153.52W	26	159	Ruby
1611-21084	March 26, 1974	0	62.44N	155.05W	27	158	McGrath
1611-21091	March 26, 1974	0	61.22N	156.13W	29	156	Sleetmute
1611-21100	March 26, 1974	5	58.36N	158.13W	31	154	Naknek - Nushagak Bay
1612-21125	March 27, 1974	0	68.07N	150.47W	23	164	Chandler Lake
1612-21131	March 27, 1974	0	66.47N	152.25W	25	163	Bettles
1612-21134	March 27, 1974	0	65.26N	153.53W	26	161	Melozitna
1612-21140	March 27, 1974	0	64.06N	155.14W	27	159	Ruby
1612-21143	March 27, 1974	0	62.44N	156.28W	28	158	Iditarod
1612-21145	March 27, 1974	0	61.22N	157.37W	29	156	Sleetmute
1612-21152	March 27, 1974	10	59.59N	158.40W	30	155	Goodnews - Dillingham
1612-21154	March 27, 1974	20	58.36N	159.38W	31	154	Hagemeister Island - Nushagak Bay
1613-21174	March 28, 1974	10	70.43N	148.24W	22	169	Beechey Point
1613-21181	March 28, 1974	10	69.25N	150.28W	23	166	Umiat
1613-21183	March 28, 1974	0	68.06N	152.17W	24	164	Chandler Lake
1613-21190	March 28, 1974	10	66.46N	153.55W	25	163	Hughes
1613-21192	March 28, 1974	0	65.26N	155.24W	26	161	Melozitna
1613-21195	March 28, 1974	0	64.05N	156.44W	27	159	Nulato
1613-21201	March 28, 1974	5	62.44N	157.58W	28	158	Iditarod
1613-21204	March 28, 1974	5	61.22N	159.05W	29	156	Russian Mission
1614-21232	March 29, 1974	0	70.42N	149.50W	22	169	Beechey Point
1614-21235	March 29, 1974	0	69.25N	151.52W	23	166	Umiat
1614-21241	March 29, 1974	0	68.06N	153.42W	24	164	Killik River - Chandler Lake
1614-21244	March 29, 1974	0	66.47N	155.20W	25	163	Hughes
1614-21250	March 29, 1974	0	65.26N	156.48W	26	161	Kateel River - Melozitna
1615-21284	March 30, 1974	0	71.58N	149.00W	21	171	Arctic Ocean
1615-21291	March 30, 1974	20	70.42N	151.18W	22	169	Harrison Bay
1615-21293	March 30, 1974	0	69.24N	153.21W	24	166	Ikpikpuk River
1615-21300	March 30, 1974	0	68.06N	155.10W	25	164	Killik River
1615-21302	March 30, 1974	0	66.46N	156.48W	26	163	Shungnak
1615-21305	March 30, 1974	0	65.26N	158.16W	27	161	Kateel River
1616-21342	March 31, 1974	0	71.50N	150.25W	22	171	Arctic Ocean
1616-21345	March 31, 1974	10	70.41N	152.43W	23	169	Harrison Bay
1616-21351	March 31, 1974	15	69.24N	154.45W	24	167	Ikpikpuk River
1616-21354	March 31, 1974	0	68.06N	156.34W	25	164	Howard Pass
1616-21360	March 31, 1974	0	66.46N	158.12W	26	163	Shungnak
1616-21363	March 31, 1974	0	65.26N	159.40W	27	161	Candle
1616-21365	March 31, 1974	0	64.05N	161.01W	28	159	Norton Bay
1616-21372	March 31, 1974	15	62.44N	162.14W	29	158	Holy Cross
1616-21374	March 31, 1974	15	61.22N	163.23W	31	156	Marshall
1617-19595	April 1, 1974	0	62.44N	137.54W	30	158	East of Nabesna
1617-20001	April 1, 1974	10	61.23N	139.02W	31	156	East of McCarthy
1617-20004	April 1, 1974	20	60.00N	140.05W	32	155	Mt. St. Elias - Yakutat
1617-20010	April 1, 1974	0	58.37N	141.03W	33	153	Pacific Ocean
1617-21401	April 1, 1974	0	72.00N	151.47W	22	171	N. of Harrison Bay, Arctic Ocean
1617-21403	April 1, 1974	0	70.44N	154.05W	23	169	Teshekpuk
1617-21410	April 1, 1974	0	69.27N	156.08W	24	167	Lookout Ridge
1617-21412	April 1, 1974	0	68.09N	157.58W	25	165	Howard Pass
1617-21415	April 1, 1974	0	66.50N	159.36W	27	163	Shungnak
1617-21421	April 1, 1974	0	65.29N	161.06W	28	161	Candle
1617-21424	April 1, 1974	0	64.09N	162.26W	29	159	Norton Bay
1617-21430	April 1, 1974	0	62.47N	163.40W	30	158	Kwiguk
1618-20053	April 2, 1974	0	62.44N	139.19W	30	158	East of Nabesna
1618-20055	April 2, 1974	0	61.21N	140.26W	31	156	McCarthy
1618-21455	April 2, 1974	0	71.57N	153.16W	22	171	N. of Teshekpuk
1618-21462	April 2, 1974	0	70.41N	155.34W	24	169	Barrow - Teshekpuk
1618-21464	April 2, 1974	0	69.24N	157.37W	25	167	Lookout Ridge
1618-21471	April 2, 1974	0	68.06N	159.26W	26	165	Misheguk Mtn.
1618-21473	April 2, 1974	0	66.46N	161.05W	27	163	Noatak
1618-21480	April 2, 1974	0	65.26N	162.34W	28	161	Bendeleben
1618-21482	April 2, 1974	0	64.05N	163.54W	29	159	Solomon
1618-21485	April 2, 1974	0	62.44N	165.06W	30	158	Kwiguk
1619-20105	April 3, 1974	0	64.06N	139.34W	30	159	East of Eagle
1619-20111	April 3, 1974	0	62.44N	140.47W	31	158	East of Nabesna
1619-20114	April 3, 1974	0	61.22N	141.54W	32	156	McCarthy
1619-21513	April 3, 1974	0	71.57N	154.45W	23	171	Barrow
1619-21520	April 3, 1974	0	70.40N	157.03W	24	169	Meade River
1619-21522	April 3, 1974	0	69.23N	159.05W	25	167	Utukok River
1619-21525	April 3, 1974	0	68.05N	160.54W	26	165	Misheguk Mtn.
1619-21531	April 3, 1974	0	66.45N	162.32W	27	163	Kotzebue
1619-21534	April 3, 1974	0	65.25N	164.01W	28	161	Bendeleben
1620-20161	April 4, 1974	0	65.26N	139.40W	29	161	East of Charley River
1620-20163	April 4, 1974	0	64.05N	141.01W	30	159	Eagle

1620-20170	April 4, 1974	0	62.43N	142.14W	31	158	Nabesna
1620-21572	April 4, 1974	20	71.59N	156.08W	23	171	Arctic Ocean
1620-21574	April 4, 1974	20	70.43N	158.27W	24	169	Barrow - Meade River
1620-21581	April 4, 1974	20	69.26N	160.29W	25	167	Utukok River
1620-20212	April 5, 1974	0	66.47N	139.32W	28	163	East of Black River
1621-20215	April 5, 1974	0	65.27N	141.01W	29	161	Charley River
1621-20221	April 5, 1974	20	64.06N	142.22W	30	159	Eagle
1621-22030	April 5, 1974	0	71.58N	157.35W	24	171	Barrow
1621-22032	April 5, 1974	10	70.42N	159.53W	25	169	Meade River
1621-22035	April 5, 1974	10	69.25N	161.55W	26	167	Utukok River
1621-22050	April 5, 1974	20	65.27N	166.50W	29	161	Teller
1622-22100	April 6, 1974	5	68.06N	165.10W	27	165	Point Hope
1622-20264	April 6, 1974	0	68.06N	139.22W	27	165	East of Table Mtn.
1623-20320	April 7, 1974	0	69.25N	139.03W	27	167	Herschel Island
1623-22154	April 7, 1974	10	68.05N	166.41W	28	165	Point Hope
1623-22160	April 7, 1974	20	66.46N	168.19W	29	163	Bering Straits
1624-20374	April 8, 1974	0	69.23N	140.31W	27	167	Herschel Island
1625-20430	April 9, 1974	0	70.40	139.56W	26	169	Arctic Ocean
1625-20432	April 9, 1974	0	69.23N	141.57W	27	167	Demarcation Point
1625-20435	April 9, 1974	0	68.05N	143.46W	29	165	Table Mt.
1625-22262	April 9, 1974	0	70.39N	165.45W	26	169	Arctic Ocean
1625-22264	April 9, 1974	0	69.22N	167.46W	27	167	Chukchi Sea
1625-22271	April 9, 1974	0	68.03N	169.35W	29	165	Chukchi Sea
1626-20484	April 10, 1974	0	70.40N	141.22W	27	169	Barter Island
1626-20491	April 10, 1974	0	69.22N	143.24W	28	167	Demarcation Point
1626-20500	April 10, 1974	20	66.44N	146.50W	30	163	Fort Yukon
1626-20502	April 10, 1974	30	65.23N	148.17W	31	161	Fairbanks - Livengood
1626-20505	April 10, 1974	25	64.02N	149.37W	32	159	Fairbanks - Healy
1627-20543	April 11, 1974	0	70.38N	142.49W	27	169	Barter Island
1627-20545	April 11, 1974	0	69.21N	144.50W	28	167	Mt. Michelson
1627-20552	April 11, 1974	0	68.03N	146.39W	29	165	Arctic
1628-21003	April 12, 1974	2	69.21N	146.22W	29	167	Mt. Michelson
1628-21010	April 12, 1974	0	68.03N	148.10W	30	165	Philip Smith Mtns.
1628-21012	April 12, 1974	0	66.44N	149.48W	31	163	Beaver
1628-21033	April 12, 1974	25	59.56N	155.57W	36	154	Illiamna
1631-21174	April 15, 1974	10	69.23N	150.37W	30	167	Umiat
1631-21181	April 15, 1974	25	68.04N	152.26W	31	165	Chandler Lake
1632-21250	April 16, 1974	10	64.03N	158.16W	34	159	Nulato
1632-21253	April 16, 1974	25	62.41N	159.28W	36	158	Iditarod
1634-19540	April 18, 1974	5	61.22N	137.37W	37	156	North of Skagway
1634-21340	April 18, 1974	0	71.58N	150.32W	28	172	Arctic Ocean
1634-21342	April 18, 1974	15	70.42N	152.50W	30	169	Harrison Bay
1635-19592	April 19, 1974	0	62.43N	137.59W	37	158	East of Nabesna
1635-19595	April 19, 1974	0	61.21N	139.07W	38	156	East of McCarthy
1637-20111	April 21, 1974	10	61.23N	141.53W	38	156	McCarthy
1638-21572	April 22, 1974	5	70.41N	158.29W	31	170	Meade River
1638-21574	April 22, 1974	0	69.24N	160.31W	32	167	Utukok River
1638-21581	April 22, 1974	0	68.05N	162.21W	33	165	DeLong Mt.
1638-21583	April 22, 1974	0	66.46N	163.58W	34	163	Cape Espenberg
1639-22023	April 23, 1974	0	71.56N	157.45W	30	172	N. Barrow
1639-22030	April 23, 1974	0	70.40N	160.02W	31	170	Wainwright
1639-22032	April 23, 1974	0	69.23N	162.05W	32	167	Point Lay
1641-20320	April 25, 1974	0	68.02N	140.56W	34	165	Table Mtn.
1641-20322	April 25, 1974	0	66.43N	142.33W	35	163	Black River
1641-20325	April 25, 1974	10	65.23N	144.02W	36	161	Circle
1641-20331	April 25, 1974	5	64.02N	145.22W	38	159	Big Delta
1641-20334	April 25, 1974	20	62.40N	146.36W	39	157	Gulkona
1641-20340	April 25, 1974	20	61.18N	147.44W	40	156	Anchorage - Valdez
1642-20381	April 26, 1974	0	66.46N	143.59W	36	163	Fort Yukon
1642-20383	April 26, 1974	0	65.25N	145.27W	37	161	Circle
1642-20390	April 26, 1974	0	64.05N	146.47W	38	159	Fairbanks - Delta
1642-20392	April 26, 1974	0	62.43N	148.01W	39	157	Talkeetna Mt.
1642-20395	April 26, 1974	0	61.21N	149.09W	40	156	Anchorage
1643-20432	April 27, 1974	0	68.04N	143.49W	35	165	Table Mt.
1643-20435	April 27, 1974	0	66.45N	145.27W	36	163	Fort Yukon
1643-20441	April 27, 1974.	0	65.24N	146.54W	37	161	Fairbanks
1643-22255	April 27, 1974	0	70.42N	165.43W	33	170	Arctic Ocean
1643-22261	April 27, 1974	0	69.25N	167.44W	34	167	Arctic Ocean
1643-22264	April 27, 1974	0	68.06N	169.34W	35	165	Chukchi Sea
1646-20594	April 30, 1974	15	70.40N	144.17W	34	170	Barter Island
1646-21001	April 30, 1974	0	69.22N	146.18W	35	167	Mt. Michelson
1646-21003	April 30, 1974	0	68.03N	148.07W	36	167	Philip Smith Mts.
1646-21010	April 30, 1974	0	66.44N	149.44W	37	163	Beaver
1646-21012	April 30, 1974	0	65.24N	151.12W	38	161	Tanana
1646-21015	April 30, 1974	0	64.03N	152.32W	39	159	Kantishna River
1646-21021	April 30, 1974	0	62.42N	153.46W	40	157	Talkeetna
1646-21024	April 30, 1974	0	61.19N	154.53W	41	155	Lime Hills
1647-21064	May 1, 1974	10	66.47N	151.13W	37	163	Bettles
1647-21070	May 1, 1974	10	65.27N	152.41W	38	161	Tanana
1647-21073	May 1, 1974	5	64.06N	154.01W	39	159	Ruby
1647-21075	May 1, 1974	0	62.44N	155.14W	40	157	McGrath
1647-21082	May 1, 1974	0	61.22N	156.21W	42	155	Lime Hills
1649-21171	May 3, 1974	0	69.24N	150.40W	36	167	Umiat
1649-21180	May 3, 1974	5	66.46N	154.04W	38	163	Hughes
1649-21183	May 3, 1974	0	65.[illegible]N	15[illegible].32W	39	161	Mel[illegible]itna
[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	159	[illegible]

1649-21192	May 3, 1974	0	62.43N	158.06W	41	157	Iditarod
1649-21194	May 3, 1974	0	61.21N	159.14W	42	155	Russian Mission
1650-21223	May 4, 1974	10	70.44N	149.58W	35	170	Beechey Point
1650-21230	May 4, 1974	10	69.27N	152.00W	36	167	Umiat
1650-21232	May 4, 1974	0	68.08N	153.48W	37	165	Killik River
1650-21235	May 4, 1974	0	66.49N	155.25W	38	163	Survey Pass
1650-21241	May 4, 1974	0	65.29N	156.54W	39	161	Kateel River
1650-21244	May 4, 1974	0	64.08N	158.15W	40	159	Nulato
1650-21250	May 4, 1974	0	62.47N	159.29W	41	157	Holy Cross
1650-21253	May 4, 1974	0	61.25N	160.37W	42	155	Russian Mission
1650-21255	May 4, 1974	0	60.02N	161.39W	43	154	Bethel
1651-21275	May 5, 1974	0	71.58N	149.05W	34	172	Arctic Ocean
1651-21281	May 5, 1974	40	70.43N	151.23W	35	170	Harrison Bay
1651-21284	May 5, 1974	40	69.25N	153.25W	36	167	Ikpikpuk River
1651-21290	May 5, 1974	10	68.07N	155.14W	37	165	Killik River
1651-21293	May 5, 1974	0	66.48N	156.51W	38	163	Shungnak
1651-21295	May 5, 1974	0	65.28N	158.19W	39	161	Kateel River
1651-21302	May 5, 1974	0	64.06N	159.39W	41	159	Norton Bay
1651-21304	May 5, 1974	0	62.45N	160.53W	42	157	Holy Cross
1651-21311	May 5, 1974	0	61.23N	162.00W	43	155	Russian Mission
1652-21345	May 6, 1974	20	68.09N	156.39W	37	165	Howard Pass
1652-21351	May 6, 1974	10	66.50N	158.18W	39	163	Shungnak
1652-21354	May 6, 1974	10	65.29N	159.47W	40	161	Candle
1652-21360	May 6, 1974	0	64.08N	161.07W	41	159	Norton Bay
1652-21363	May 6, 1974	1	62.47N	162.20W	42	157	Kwiguk
1652-21365	May 6, 1974	1	61.25N	163.27W	43	155	Marshall
1652-21372	May 6, 1974	5	60.03N	164.29W	44	153	Baird Inlet
1653-21394	May 7, 1974	0	70.45N	154.18W	36	170	Teshekpuk
1653-21400	May 7, 1974	0	69.28N	156.20W	37	167	Lookout Ridge
1653-21403	May 7, 1974	10	68.09N	158.10W	38	165	Howard Pass
1653-21405	May 7, 1974	10	66.50N	159.47W	39	163	Selawik
1653-21414	May 7, 1974	10	64.09N	162.37W	41	159	Solomon
1653-21421	May 7, 1974	0	62.47N	163.51W	42	157	Kwiguk
1654-21450	May 8, 1974	0	71.59N	153.26W	35	172	Arctic Ocean
1654-21452	May 8, 1974	10	70.43N	155.44W	36	170	Barrow
1654-21473	May 8, 1974	5	64.07N	164.02W	41	159	Solomon
1655-21504	May 9, 1974	10	72.01N	154.50W	35	172	Arctic Ocean
1655-21515	May 9, 1974	0	68.10N	160.57W	38	165	Misheguk Mountain
1655-21522	May 9, 1974	10	66.50N	162.35W	39	163	Kotzebue - Selawik
1656-20151	May 10, 1974	10	65.29N	139.41W	41	161	Charley River
1656-21574	May 10, 1974	0	68.08N	162.28W	39	165	DeLong Mts
1661-20425	May 15, 1974	0	68.07N	143.47W	40	165	Table Mtn
1667-21180	May 21, 1974	20	65.33N	155.29W	43	160	Melozitna
1667-21200	May 21, 1974	5	58.42N	161.10W	48	150	Hagemeister Island
1669-21292	May 23, 1974	0	65.34N	158.16W	44	160	Kateel River
1669-21310	May 23, 1974	0	60.08N	163.01W	48	152	Baird Inlet
1670-21344	May 24, 1974	0	66.56N	158.13W	43	162	Ambler River
1670-21360	May 24, 1974	0	62.53N	162.17W	46	156	Kwiguk
1670-21362	May 24, 1974	0	61.32N	163.25W	47	154	Marshall
1671-21400	May 25, 1974	0	68.14N	158.03W	42	164	Howard Pass
1671-21405	May 25, 1974	0	65.34N	161.10W	44	160	Candle
1671-21420	May 25, 1974	0	61.29N	164.56W	47	154	Hooper Bay
1672-21454	May 26, 1974	0	68.15N	159.29W	42	164	Misheguk Mtn.
1672-21463	May 26, 1974	0	65.35N	162.37W	44	160	Bendeleben
1672-21470	May 26, 1974	0	64.16N	163.27W	45	158	Solomon
1672-21472	May 26, 1974	0	62.54N	165.11W	46	156	Black - Kwiguk
1672-21475	May 26, 1974	0	61.32N	166.19W	47	154	Hooper Bay
1673-21512	May 27, 1974	0	68.17N	160.57W	42	164	Misheguk Mtn
1673-21521	May 27, 1974	0	65.38N	164.03W	44	160	Bendeleben
1674-21573	May 28, 1974	0	66.59N	163.58W	43	162	Kotzebue
1679-20443	June 2, 1974	30	61.29N	150.34W	48	153	Tyonek
1680-20501	June 3, 1974	30	61.32N	152.00W	48	153	Tyonek
1692-20152	June 15, 1974	20	61.34N	143.17W	49	152	McCarthy
1694-22071	June 17, 1974	0	70.53N	161.16W	42	168	Barrow
1694-22073	June 17, 1974	0	69.36N	163.20W	43	165	Point Lay
1697-20421	June 20, 1974	2	66.57N	145.19W	45	160	Fort Yukon
1697-20424	June 20, 1974	1	65.36N	146.48W	46	158	Circle
1698-20491	June 21, 1974	20	62.54N	150.47W	48	153	Talkeetna
1698-20493	June 21, 1974	2	61.32N	151.54W	49	151	Tyonek
1700-20592	June 23, 1974	30	66.55N	149.40W	45	160	Beaver
1702-21093	June 25, 1974	0	70.53N	146.58W	42	167	Beechey Point
1702-21095	June 25, 1974	5	69.36N	149.03W	43	164	Sagavanirktok
1706-21322	June 29, 1974	0	70.54N	152.42W	42	167	Harrison Bay
1706-21345	June 29, 1974	0	62.54N	162.19W	48	153	St. Michael
1706-21351	June 29, 1974	0	61.31N	163.27W	49	150	Marshall
1707-21391	June 30, 1974	0	66.59N	159.43W	45	159	Baird Mts
1708-20035	July 1, 1974	0	60.10N	141.30W	50	148	Icy Bay
1709-20090	July 2, 1974	5	61.32N	141.57W	49	150	McCarthy & East

1709-21510	July 2, 1974	5	65.41N	163.58W	46	157	Bendeleben
1709-21513	July 2, 1974	0	64.20N	165.19W	47	155	Nome
1710-21551	July 3, 1974	5	70.53N	158.28W	41	167	Barrow
1710-21553	July 3, 1974	0	69.35N	160.31W	42	164	Utukok River
1710-21565	July 3, 1974	0	65.36N	165.29W	46	157	Teller, Bendeleben
1711-22023	July 4, 1974	0	65.37N	166.58W	45	157	Teller
1713-22121	July 6, 1974	5	70.52N	162.41W	41	167	Wainwright
1719-21031	July 12, 1974	0	70.49N	145.39W	40	166	Flaxman Island
1720-21103	July 13, 1974	2	65.33N	154.06W	44	156	Melozitna
1721-21143	July 14, 1974	0	70.50N	148.27W	40	166	Beechey Point
1721-21150	July 14, 1974	0	69.33N	150.30W	41	163	Umiat
1722-21202	July 15, 1974	0	70.48N	149.58W	40	166	Beechey Point
1722-21204	July 15, 1974	0	69.30N	152.02W	41	163	Umiat
1722-21211	July 15, 1974	0	68.11N	153.50W	42	161	Chandler Lake
1723-21260	July 16, 1974	0	70.48N	151.25W	40	166	Harrison Bay
1723-21262	July 16, 1974	1	69.31N	153.28W	41	163	Ikpikpuk River
1733-20433	July 26, 1974	30	58.37N	152.37W	47	146	Afognak
1734-20471	July 27, 1974	10	65.28N	148.17W	42	156	Fairbanks - Livengood
1734-20473	July 27, 1974	30	64.07N	149.38W	43	154	Healy
1734-20482	July 27, 1974	5	61.23N	151.59W	45	150	Tyonek
1734-20491	July 27, 1974	0	58.37N	153.59W	47	146	Mt. Katmai
1738-19291	July 31, 1974	20	57.14N	134.47W	47	145	Sitka
1742-21315	August 4, 1974	20	68.07N	156.44W	38	161	Howard Pass
1743-21374	August 5, 1974	0	68.07N	158.10W	37	161	Howard Pass
1744-21432	August 6, 1974	1	68.07N	159.32W	37	161	Misheguk Mtn
1744-21434	August 6, 1974	20	66.48N	161.09W	38	159	Selawik
1753-20535	August 15, 1974	0	59.57N	154.33W	41	151	Illiamna
1760-21302	August 22, 1974	0	70.40N	153.01W	30	167	Teshekpuk
1760-21305	August 22, 1974	5	69.21N	155.03W	31	165	Ikpikpuk River
1768-20342	August 30, 1974	1	65.22N	145.35W	32	160	Circle
1768-20351	August 30, 1974	20	62.38N	148.06W	34	156	Talkeetna Mts
1772-20571	Sept. 3, 1974	5	65.19N	151.16W	31	160	Tanana
1772-20583	Sept. 3, 1974	0	61.14N	154.54W	34	155	Lake Clark - Lime Hills
1772-20585	Sept. 3, 1974	2	59.52N	155.56W	35	154	Illiamna
1772-20592	Sept. 3, 1974	5	58.28N	156.54W	36	152	Naknek
1773-21011	Sept. 4, 1974	0	70.37N	145.49W	26	168	Flaxman Island
1773-21014	Sept. 4, 1974	0	69.19N	147.49W	27	166	Mt. Michelson
1773-21020	Sept. 4, 1974	0	68.01N	149.36W	28	164	Philip Smith Mtn.
1773-21025	Sept. 4, 1974	0	65.22N	152.40W	30	160	Tanana
1774-21065	Sept. 5, 1974	10	70.36N	147.16W	25	169	Beechey Point
1774-21072	Sept. 5, 1974	0	69.19N	149.16W	26	[illegible]	Sagavankirktok
1775-21124	Sept. 6, 1974	0	70.36N	148.43W	25	169	Beechey Pt.
1775-21130	Sept. 6, 1974	0	69.19N	150.44W	26	166	Sagavanirktok
1779-21361	Sept. 10, 1974	0	68.04N	158.10W	26	165	Howard Pass
1779-21364	Sept. 10, 1974	1	66.45N	159.47W	27	163	Selawik
1779-21370	Sept. 10, 1974	0	65.25N	161.15W	28	161	Candle
1789-20493	Sept. 20, 1974	5	69.21N	144.50W	21	168	Mt. Michelson
1802-20213	October 3, 1974	0	65.29N	142.28W	19	165	Charley River
1803-20263	October 4, 1974	0	68.11N	140.39W	16	168	Table Mt.
1803-20265	October 4, 1974	0	66.52N	142.17W	18	166	Coleen
1805-20373	Oct. 6, 1974	10	69.25N	141.40W	15	170	Demarcation Pt.
1809-21012	Oct. 10, 1974	0	66.54N	150.53W	15	167	Bettles
1812-21172	Oct. 13, 1974	15	70.50N	149.32W	11	173	Beechey Pt.
1812-21174	Oct. 13, 1974	10	69.32N	151.36W	12	171	Umiat
1814-21302	Oct. 15, 1974	0	65.36N	159.26W	15	166	Candle
1816-19595	Oct. 17, 1974	10	61.28N	140.23W	18	162	McCarthy & East
1817-21460	Oct. 18, 1974	0	70.47N	156.46W	09	173	Barrow
1817-21462	Oct. 18, 1974	0	69.30N	158.50W	10	171	Lookout Ridge
1817-21471	Oct. 18, 1974	3	66.52N	162.19W	12	168	Kotzebue

APPENDIX C

SUMMARIES OF DEMONSTRATION PROJECTS

U OF A INVESTIGATOR/AFFILIATION: Miller

U OF A ERTS PROJECT NO. (If any): --- Code Y

AGENCY CONTACT/AFFILIATION: Jack Roderick, Mayor, Greater Anchorage Area Borough

DESCRIPTION OF AGENCY'S REQUEST AND/OR PROBLEM:

provision of updated resource base for operational planning needs.

APPROACH TO SOLUTION OF PROBLEM USING ERTS AND/OR AIRCRAFT DATA:
(list ERTS data by scene ID and provide illustrations if appropriate)

We provided 1:250,000 color enlargement of 1390-20450 containing the Anchorage-Cook Inlet area, plus an 8"x10" reproduction of the B+W Cook Inlet mosaic from 3-5 Nov 1972.

PARTICIPATION OF AGENCY IN ERTS/AIRCRAFT DATA INTERPRETATION:

[] minimal [] supervisory [] extensive [x] total (no U of A involvement except for providing data)

RESULTS OF INVESTIGATION:

This is a "bridge-building" effort which should be developed for additional applications. User paid 100% of product costs, and essentially there has been no interpretation. Products used chiefly for display and "show-and-tell".

DECISIONS MADE BY AGENCY BASED ON RESULTS OF INVESTIGATION:

Pending

ESTIMATED COST BENEFITS:

Estimated total cost of investigation by conventional means: $20,000.00

Estimated total cost of investigation by ERTS/Aircraft remote sensing: $ 34.00

U OF A INVESTIGATOR/AFFILIATION: Miller

U OF A ERTS PROJECT NO. (If any): --- Code Y

AGENCY CONTACT/AFFILIATION: Richard Montague, Alaska Travel Publications Inc.

DESCRIPTION OF AGENCY'S REQUEST AND/OR PROBLEM:

User desired scenes of Mt. McKinley National Park and the Katmai National Monument areas, for use in publications.

APPROACH TO SOLUTION OF PROBLEM USING ERTS AND/OR AIRCRAFT DATA:
(list ERTS data by scene ID and provide illustrations if appropriate)

We provided enlargements of scenes 1104-20563, 1105-21021, and 1033-21020 in B+W, 1:1M and 1:500K B+W prints of 1428-20563, plus 1 1:250K color of the latter scene. User paid direct costs of product preparation.

PARTICIPATION OF AGENCY IN ERTS/AIRCRAFT DATA INTERPRETATION:

[] minimal [] supervisory [] extensive [x] total (no U of A involvement except for providing data)

RESULTS OF INVESTIGATION:

n/a

DECISIONS MADE BY AGENCY BASED ON RESULTS OF INVESTIGATION:

n/a

ESTIMATED COST BENEFITS:

Estimated total cost of investigation by conventional means: $

Estimated total cost of investigation by ERTS/Aircraft remote sensing: $

U OF A INVESTIGATOR/AFFILIATION: Miller

U OF A ERTS PROJECT NO. (If any): --- Code Y

AGENCY CONTACT/AFFILIATION: Virginia Gibbs/Mike Tauriainen, Kenai Peninsula Borough

DESCRIPTION OF AGENCY'S REQUEST AND/OR PROBLEM:

User desired updated resource base for regional planning, and desired some ERTS images of the Kenai Peninsula region.

APPROACH TO SOLUTION OF PROBLEM USING ERTS AND/OR AIRCRAFT DATA:
(list ERTS data by scene ID and provide illustrations if appropriate)

We provided a 9" color print at 1:1M, and a 1:250K color print of 1390-20452. User paid for direct cost of product preparation.

PARTICIPATION OF AGENCY IN ERTS/AIRCRAFT DATA INTERPRETATION:

[X] minimal [] supervisory [] extensive [X] total (no U of A involvement except for providing data)

RESULTS OF INVESTIGATION:

Pending further follow-up contact.

DECISIONS MADE BY AGENCY BASED ON RESULTS OF INVESTIGATION:

pending

ESTIMATED COST BENEFITS:
Estimated total cost of investigation by conventional means: $20,000
Estimated total cost of investigation by ERTS/Aircraft remote sensing: $25.00

U OF A INVESTIGATOR/AFFILIATION: Miller

U OF A ERTS PROJECT NO. (If any): --- Code Y

AGENCY CONTACT/AFFILIATION: Phil Holdsworth, INEXCO Mining Co.

DESCRIPTION OF AGENCY'S REQUEST AND/OR PROBLEM:

Assistance in applying ERTS imagery to mineral ore exploration in Wrangell Mountains. User desired satellite images enlarged to 1:250,000 as an additional tool in mineral development activities.

APPROACH TO SOLUTION OF PROBLEM USING ERTS AND/OR AIRCRAFT DATA:
(list ERTS data by scene ID and provide illustrations if appropriate)

We prepared 1:250K scale B+W prints of 1422-20212 for interpretation by user. We also suggested that he consider color enhancement of the images for possible correlation with major rock outcrop classifications. User was billed for direct costs of product preparation.

PARTICIPATION OF AGENCY IN ERTS/AIRCRAFT DATA INTERPRETATION:

[] minimal [] supervisory [] extensive [x] total (no U of A involvement except for providing data)

RESULTS OF INVESTIGATION:

Pending. User invited to submit report form.

DECISIONS MADE BY AGENCY BASED ON RESULTS OF INVESTIGATION:

Pending further follow-up work.

ESTIMATED COST BENEFITS:

Estimated total cost of investigation by conventional means: $20,000

Estimated total cost of investigation by ERTS/Aircraft remote sensing: 20.00

U OF A INVESTIGATOR/AFFILIATION: Miller

U OF A ERTS PROJECT NO. (If any): --- Code Y

AGENCY CONTACT/AFFILIATION: Michael Mitchell & Jim Movius, R&M Engineering & Geological Consultants

DESCRIPTION OF AGENCY'S REQUEST AND/OR PROBLEM:

User requested ERTS imagery to support geologic field work

APPROACH TO SOLUTION OF PROBLEM USING ERTS AND/OR AIRCRAFT DATA:
(list ERTS data by scene ID and provide illustrations if appropriate)

We prepared 1103-20513 print in B+W at a scale of 1:500K, scenes 1410-20551, 1411-21003 and 1410-20545 in b+W at a scale of 1:250K, and 1411-21003 at a scale of 1:63,360.

PARTICIPATION OF AGENCY IN ERTS/AIRCRAFT DATA INTERPRETATION:

[] minimal [] supervisory [] extensive [x] total (no U of A involvement except for providing data)

RESULTS OF INVESTIGATION:

unknown

DECISIONS MADE BY AGENCY BASED ON RESULTS OF INVESTIGATION:

unknown

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ESTIMATED COST BENEFITS: n/a

Estimated total cost of investigation by conventional means: $80,000

Estimated total cost of investigation by ERTS/Aircraft remote sensing: $ 75.00

U OF A INVESTIGATOR/AFFILIATION: Miller

U OF A ERTS PROJECT NO. (If any): --- Code Y

AGENCY CONTACT/AFFILIATION: R. W. Crebbs, Susan Cage, Gulf Oil Co.

DESCRIPTION OF AGENCY'S REQUEST AND/OR PROBLEM:

User needs additional tools to help determine geological faulting, fracturing and other lineaments previously undetected by conventional mapping.

APPROACH TO SOLUTION OF PROBLEM USING ERTS AND/OR AIRCRAFT DATA:
(list ERTS data by scene ID and provide illustrations if appropriate)

We assembled a 9-scene ERTS mosaic of Cook Inlet at a scale of 1:500,000 for interpretation by the user for unspecified exploration uses.

PARTICIPATION OF AGENCY IN ERTS/AIRCRAFT DATA INTERPRETATION:

[] minimal [] supervisory [] extensive [x] total (no U of A involvement except for providing data)

RESULTS OF INVESTIGATION:

Unknown

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DECISIONS MADE BY AGENCY BASED ON RESULTS OF INVESTIGATION:

Unknown

ESTIMATED COST BENEFITS: n/a
Estimated total cost of investigation by conventional means: 180,000 $
Estimated total cost of investigation by ERTS/Aircraft remote [illegible]: 20,000

U OF A INVESTIGATOR/AFFILIATION: Miller

U OF A ERTS PROJECT NO. (If any): --- Code Y

AGENCY CONTACT/AFFILIATION: John A. Robertson, Ketchikan Gateway Borough

DESCRIPTION OF AGENCY'S REQUEST AND/OR PROBLEM:

Color infrared image desired of Borough for preparation of a comprehensive master plan of regional development. (User became acquainted with ERTS capabilities from the Alaska Magazine article of September 1973).

APPROACH TO SOLUTION OF PROBLEM USING ERTS AND/OR AIRCRAFT DATA:
(list ERTS data by scene ID and provide illustrations if appropriate)

A 3-scene mosaic in color was prepared from 1358-19264, 1392-19151, and 1392-19145 at a scale of 1:150,000 rather than the desired scale of 1:250,000 requested by the user. A decision is pending whether to accept the larggr scale or to make another set of prints.

This project was delayed many months owing to scene 1358-19264 color reconstitution as initially received from NDPF being of unuseable quality.

PARTICIPATION OF AGENCY IN ERTS/AIRCRAFT DATA INTERPRETATION:

[x] minimal [] supervisory [] extensive [x] total (no U of A involvement except for providing data)

RESULTS OF INVESTIGATION:

Pending

DECISIONS MADE BY AGENCY BASED ON RESULTS OF INVESTIGATION:

Pending

ESTIMATED COST BENEFITS:
Estimated total cost of investigation by conventional means: $20,000
Estimated total cost of investigation by ERTS/Aircraft remote sensing: $200

U OF A INVESTIGATOR/AFFILIATION: Miller

U OF A ERTS PROJECT NO. (If any): --- Code Y

AGENCY CONTACT/AFFILIATION: Mr. Bob Lambeth, AMAX Coal Co Div American Metal Climax Inc.

DESCRIPTION OF AGENCY'S REQUEST AND/OR PROBLEM:

Determine bedrock structural trends in areas of tundra cover in Alaska.

APPROACH TO SOLUTION OF PROBLEM USING ERTS AND/OR AIRCRAFT DATA:
(list ERTS data by scene ID and provide illustrations if appropriate)

Pending. We have responded with bibliography of references for geologic applications of ERTS images, plus a description of the technical specifications of ERTS photo products. An approach will be determined after further consultation with user.

PARTICIPATION OF AGENCY IN ERTS/AIRCRAFT DATA INTERPRETATION:

[] minimal [] supervisory [] extensive [x] total (no U of A involvement except for providing data)

RESULTS OF INVESTIGATION:

n/a

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DECISIONS MADE BY AGENCY BASED ON RESULTS OF INVESTIGATION:

n/a

ESTIMATED COST BENEFITS: n/a

Estimated total cost of investigation by conventional means: $

Estimated total cost of investigation by ERTS/Aircraft remote sensing: $

U OF A INVESTIGATOR/AFFILIATION: Miller

U OF A ERTS PROJECT NO. (If any): --- Code Y

AGENCY CONTACT/AFFILIATION: John Moore, City of Fairbanks.

DESCRIPTION OF AGENCY'S REQUEST AND/OR PROBLEM:

User requested representative samples of remote sensing imagery that is available of the Fairbanks area, especially from aircraft coverage. Satellite images have insufficient resolution for urban planning purposes of the City of Fairbanks.

APPROACH TO SOLUTION OF PROBLEM USING ERTS AND/OR AIRCRAFT DATA:
(list ERTS data by scene ID and provide illustrations if appropriate)

We ordered a 40" x 40" color infrared print and a 9" print of NASA MIssion 209 frame 157 roll 2 from EROS Data Center 4/2/74. It arrived 5/23/74, but was given to League of Women Voters who urgently needed the same product for display purposes as part of their Land Use Planning public information campaign.

We also prepared in our lab 9" color prints of Mission 209, roll 8, f rame 219 and roll 7, frame 219 for the City of Fairbanks. User paid the direct costs of data preparation.

PARTICIPATION OF AGENCY IN ERTS/AIRCRAFT DATA INTERPRETATION:

[] minimal [] supervisory [] extensive [x] total (no U of A involvement except for providing data)

RESULTS OF INVESTIGATION:

Pending further follow-on with user.

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DECISIONS MADE BY AGENCY BASED ON RESULTS OF INVESTIGATION:

Pending.

ESTIMATED COST BENEFITS: n/a

Estimated total cost of investigation by conventional means: $

Estimated total cost of investigation by ERTS/Aircraft remote sensing: $

U OF A INVESTIGATOR/AFFILIATION: Miller

U OF A ERTS PROJECT NO. (If any): --- Code Y

AGENCY CONTACT/AFFILIATION: Wesley R. Wilson, City and Borough of Juneau

DESCRIPTION OF AGENCY'S REQUEST AND/OR PROBLEM:

Photography of urbanized area suitable for large format public display purposes at a scale of approximately 1:40K.

APPROACH TO SOLUTION OF PROBLEM USING ERTS AND/OR AIRCRAFT DATA:
(list ERTS data by scene ID and provide illustrations if appropriate)

Consultation with user revealed that ERTS imagery would not be suitable for the intended application. The urbanized area around Juneau does not encompass sufficient area to be resolved by ERTS in the detail that would be required.

PARTICIPATION OF AGENCY IN ERTS/AIRCRAFT DATA INTERPRETATION:

[] minimal [] supervisory [] extensive [x] total (no U of A involvement except for providing data)

RESULTS OF INVESTIGATION:

n/a

DECISIONS MADE BY AGENCY BASED ON RESULTS OF INVESTIGATION:

n /a

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ESTIMATED COST BENEFITS:
Estimated total cost of investigation by conventional means: $
Estimated total cost of investigation by ERTS/Aircraft remote sensing: $

ERTS SPECIAL PROJECTS

Cooperative activities of the University of Alaska and other agencies

U OF A INVESTIGATOR/AFFILIATION: George/Anderson

U OF A ERTS PROJECT NO. (if any): Code Y

AGENCY CONTACT/AFFILIATION: Greg S. Thies, Asst to Mayor, and Jack Coghill, Mayor City of Nenana, Box 177, Nenana, AK 99760 832-5441.

DESCRIPTION OF AGENCY'S REQUEST AND/OR PROBLEM:

The City of Nenana is interested in surveying the agricultural potential of an area west of Nenana near the Totchaket Slough. A 125 square mile region is being studied for possible development into irrigated farming on lands controlled in part by Na tive regional corporations and the State of Alaska.

APPROACH TO SOLUTION OF PROBLEM USING ERTS AND/OR AIRCRAFT DATA:

We have proposed a definitive vegetation map be prepared from ERTS data including low altitude aerial photography of training sites. A provisional (and tentative) ve getation map of the area was prepared on short notice from previously prepared color ERTS images to demonstrate the utility of satellite remote sensing data to refinement of proposed boundaries of the lands suited to agriculture, as well as to demonstrate the ability of this technique to classify within the area a heirarchical listing of lands by their agricultural potential.

PARTICIPATION OF AGENCY IN ERTS/AIRCRAFT DATA INTERPRETATION:

[x] minimal [ ] supervisory [ ] extensive [ ] total (no U of A involvement except for providing data)

RESULTS OF INVESTIGATION:

It is expected that the City of Nenana will request a detailed and verified vegetative map be prepared from multistage sampling techniques based upon the effective presentation of the value of the fast-response provisional map. (The provisional map was prepared within a week of the time we learned of the possible application. This again demonstrates the value of timely data retrieval and custom processing. The lead times of normal data formats from national data center sources would have precluded the development of this application, which is classically well-suited for satellite remote sensing.)

DECISIONS MADE BY AGENCY BASED ON RESULTS OF INVESTIGATION:

A formal agreement to proceed with a thorough, definitive vegetative map should be completed within a few weeks.

ESTIMATED COST BENEFITS:

Estimated total cost of investigation by conventional means:

Estimated total cost of investigation by ERTS/Aircraft remote sensing:

U OF A INVESTIGATOR/AFFILIATION: Belon

U OF A ERTS PROJECT NO. (If any): --- Code Y

AGENCY CONTACT/AFFILIATION: Dermott R. O'Toole

DESCRIPTION OF AGENCY'S REQUEST AND/OR PROBLEM:

Requested satellite photo of Chichagof Island.

APPROACH TO SOLUTION OF PROBLEM USING ERTS AND/OR AIRCRAFT DATA:
(list ERTS data by scene ID and provide illustrations if appropriate)

We prepared a 1:250,000 scale color print of desired area, and user paid for direct costs of preparation.

PARTICIPATION OF AGENCY IN ERTS/AIRCRAFT DATA INTERPRETATION:

[] minimal [] supervisory [] extensive [x] total (no U of A involvement except for providing data)

RESULTS OF INVESTIGATION:

Unknown

DECISIONS MADE BY AGENCY BASED ON RESULTS OF INVESTIGATION:

Unknown

ESTIMATED COST BENEFITS:

Estimated total cost of investigation by conventional means: $20,000

Estimated total cost of investigation by ERTS/Aircraft remote sensing: $30.00

APPENDIX D

KENAI RIVER HARBOR

SEDIMENTATION STUDY DATA ACQUISITION PLAN

KENAI RIVER SEDIMENTATION STUDY

DATA ACQUISITION PLAN

1. PURPOSE

The goal of this project is to relate the gray scale density levels from remotely sensed images (aircraft photography) to surface suspended sediment concentration in a typical sediment laden Alaskan estuary. This is a pilot project designed to test the feasibility of using remote sensing techniques as an input when selecting sites for small craft harbors in a manner to minimize shoaling problems.

2. METHOD

Simultaneous water samples and aerial photography will be acquired six times throughout flood tide stage one day during July 17 - 21, in accordance with Schedule I, attached. These times were selected to bracket equal level increments between low and high tides at the Kenai City Pier. Two river transects and 7 aircraft flight lines will be made for each of the six missions scheduled. See attached map.

The water samples and photographs will be analyzed later during the summer and fall to determine the correlation between measured sediment in milligrams/liter and density on the photography.

3. PROCEDURE

The following persons will participate in this study:

Mr. John M. Miller Geophysical Institute University of Alaska Fairbanks, Alaska 99701	Project Coordinator 907-479-7291 or 452-6645
Dr. Craig Everts Coastal Engineering Research Center Kingman Building Ft. Belvoir, Virginia 22060	Project Consultant 202-325-7381
Dr. Frederick F. Wright Marine Advisory Program 707 A Street Anchorage, Alaska 99501	Oceanographer 907-279-4523 or 344-9797
Mr. David Burbank Institute of Marine Science University of Alaska Fairbanks, Alaska 99701	Oceanographer and Data Analysis 907-479-7743

Dr. G. D. Sharma Institute of Marine Science University of Alaska Fairbanks, Alaska 99701	Water Sample Analysis 907-479-7743 or 479-2191
Mr. Tony Follett North Pacific Aerial Surveys 117 West Northern Lights Blvd. Anchorage, Alaska 99503	Aerial Photography 907-274-3548
Mr. David Hanrahan Box 267 Soldotna, Alaska 99669	River Boat Operation 907-262-5180
Mr. Tom George Geophysical Institute University of Alaska Fairbanks, Alaska 99701	Alternate 907-479-7621

Data Acquisition - Water

Two river boats will be required for transects #1 (at the mouth of the Kenai River) and #2 (1½ miles upstream). Each boat operator will be responsible for the boat's operating and logistical support requirements and will serve the needs of the scientist on board who will supervise the data collection activities. Mr. Burbank will supervise the scientific activities on boat #1, and Dr. Wright will fill the same function on boat #2.

The water sample bottles will be transported to and from Kenai by the Institute of Marine Science van truck. Burbank and Wright will maintain logs identifying each sample by date, time, and station location. Boat #1 will provide 8 stations per direct river transect, plus approximately 10 additional stations along the loop made into Cook Inlet after each river transect, time permitting. Boat #2 will provide 5 stations per transect, two relatively close to shore and one in the middle of the transect. Boat #1 will perform salinity and light penetration measurements at each station. Both boats will make a mid-river sample vertically at about 1 meter depth increments.

Data Acquisition - Photography

North Pacific Aerial Surveys will fly a Cessna 320D over the 7 flight lines detailed on the map at the six times scheduled. The I^2S multiband camera on loan from the Bureau of Sports Fish & Wildlife will be mounted in one camera port, and the Zeiss 6" camera will be mounted in the other port. The I^2S camera will use Kodak 2424 B+W IR film and produce four images per frame in the blue, green, red, and infrared wavelengths. The shutter speed will be 1/150 second, and the filter and aperture combination of the lenses shown in the table below:

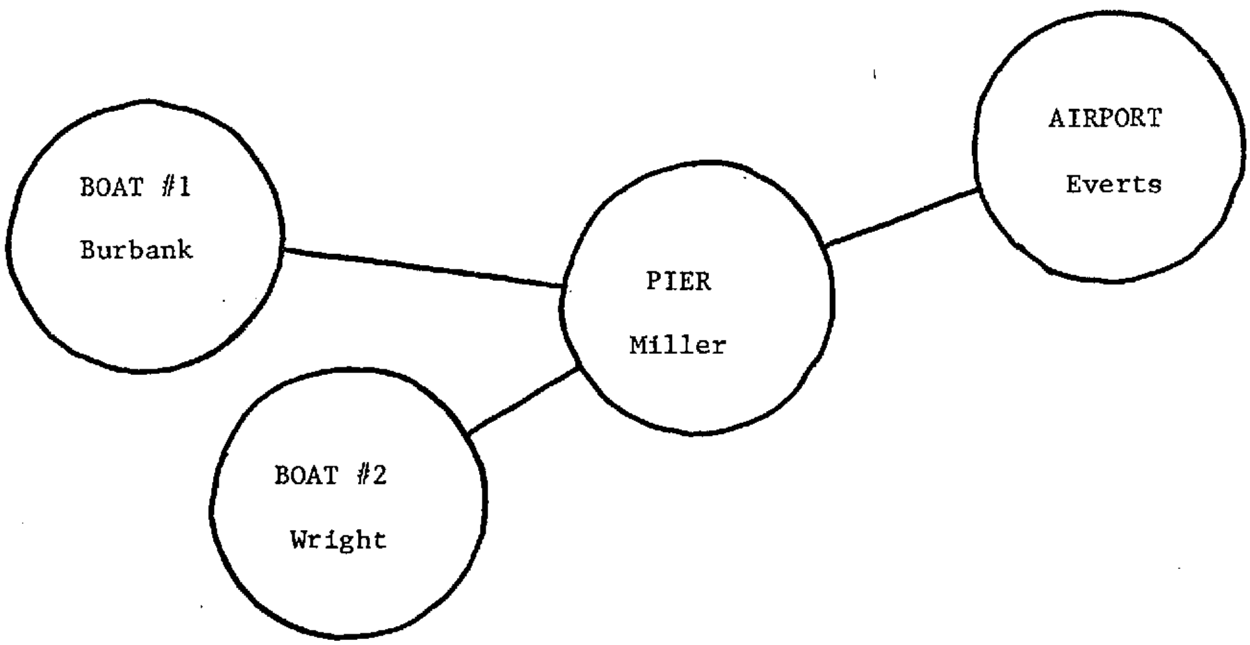
	Blue	Green	Red	Infrared	
Filter	47B	7A	25	88A	
Aperture*	5.6	2.8	2.8	5.6	(overcast)
	8	4	4	8	(clear)

The Zeiss camera will carry Ektachrome 2448 color film with exposure details selected by NPAS. Film and processing will be the responsibility of NPAS. A step wedge exposure will be provided on the leader of each roll of film.

The flight lines will be flown at 3,000 ft. altitude with 10% forward lap of frames, and camera operation will be limited to water areas as much as feasible. The flight lines may be flown in the most expeditious order so long as adequate flight line logs are maintained with reference to frame index numbers. At the conclusion of the scheduled photography mission for the day, a direction will be given for exposure of any remaining film on the rolls in the cameras, either in the vicinity of Kenai or during the ferry flight back to Anchorage.

Data Acquisition - Coordination

Project coordination will be the overall responsibility of Mr. Miller, who will work closely with Dr. Everts, Dr. Wright and Mr. Burbank. Two-way radio communications will be provided between both boats, the airport, and the coordination point, which will be the Kenai City Pier. See diagram below, which details the prime location of each individual, although there will be some interchange of position by Everts and Miller throughout the mission.



A prime daily function will be the early morning decision whether or not to proceed with the mission for that day. This decision will be made by Miller and communicated promptly to all parties three hours prior to the first event time. Barring equipment problems, the weather

will be the primary factor in making the "go, no-go" decision. A general guide is that the sky should be clear or light overcast above 10,000 feet, and the wind 15 knots or less on the ground. Broken cloud conditions are undesireable, and widely scattered clouds are marginal for uniform lighting requirements for this photography.

Data acquisition will be required at the Pier location along with coordination activities. Logs will be kept of wind speed and direction, light conditions, air and water temperature, and water samples at surface and 1 meter incremental depths at transect times.

4. DATA ANALYSIS AND INTERPRETATION

The water samples will be returned by IMS van and analyzed by Dr. Sharma for mg/l of sediment. The photographic images will be analyzed by a variety of methods by Burbank, Miller, George and Everts. Techniques will be evaluated for usefulness in best correlating the imagery with the sediment load. These will include color tone analysis (both of color transparencies and the reconstituted color images on the I^2S color additive viewer) and density slicing of the individual B+W negatives from the multispectral film and the color film. It is expected that the negative density slicing will prove most effective.

Interpretation of the analyzed data will be a joint responsibility of Sharma, Miller, Everts and Burbank. A report detailing the results and the conclusions of the study will be jointly authored by the principals by January 1975.

* Note: These exposures are optimized for water reflectances. Exposures for land terrain for overcast conditions would require apertures of 4, 2.8, 2.8, 11, respectively.

KENAI RIVER PROJECT

LOGISTICS

The following items will be required for the Kenai River Project, and the person named will be expected to arrange for it being present in operating condition at the proper time. Most transportation needs can be accommodated by the IMS van which will go from Fairbanks to Kenai and return after the project ends. Transportation needs other than the IMS van must be arranged by the responsible individual.

4 - 2-way radios (CB)	Miller
Anemometer	Miller
3 - Thermometers (^{o}C)	Miller
35 mm camera, film & light meter	Miller
Aircraft cameras, film and filters	Miller
Salinity gage	Burbank
3 - Depth samplers	Burbank
425 - Water sample bottles	Burbank
Secchi disk	Burbank
Van truck, plus miscellaneous buoys, rope, or other gear deemed appropriate.	Burbank

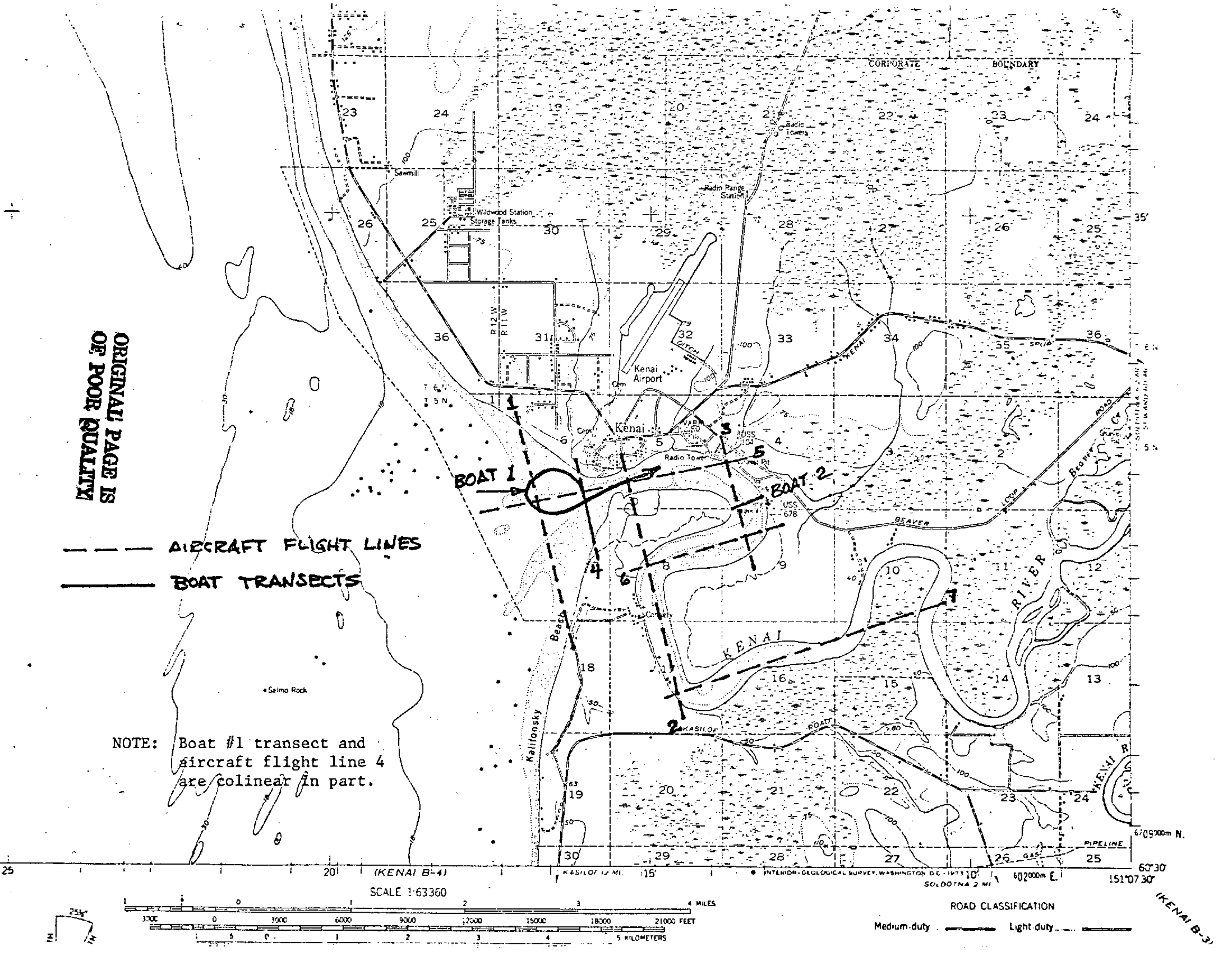
In view of the limited budget supporting this project, a bedroll and camping gear is recommended for the non-commuting participants. However, the Harborview Motel, Box 3138, Kenai, telephone 283-4133, will be used as a message center and rendezvous point as needed.

The IMS van should arrive in Kenai by Tuesday night, July 16, so that Wednesday can be devoted to planning and orientation of transects and stations, deployment of gear, etc. Miller will devote part of Monday and Tuesday in checking out the aircraft camera installation and operation with NPAS. Contact while in Anchorage will be at 1437 I Street, telephone 274-4792. Rendezvous with the van and crew will be planned for Tuesday evening in Kenai, although Wright will not fly to Kenai until the day the mission actually proceeds.

SCHEDULE I

DATA RUN SCHEDULES FOR KENAI RIVER PROJECT

Date	Start Time ADT	Tide, Ft.
July 18	10:09 a.m.	-3.6
Thursday	11:49 a.m.	
	12:36 p.m.	
	1:19 p.m.	
	2:07 p.m.	
	3:47 p.m.	+19.9
July 19	10:54 a.m.	-4.9
Friday	12:33 p.m.	
	1:20 p.m.	
	2:03 p.m.	
	2:50 p.m.	
	4:29 p.m.	+21.4
July 20	11:39 a.m.	-5.5
Saturday	1:17 p.m.	
	2:04 p.m.	
	2:46 p.m.	
	3:33 p.m.	
	5:12 p.m.	+22.4
July 21	12:22 p.m.	-5.3
Sunday	2:00 p.m.	
	2:47 p.m.	
	3:29 p.m.	
	4:16 p.m.	
	5:54 p.m.	+22.9
July 22	1:05 p.m.	-4.3
Monday	2:43 p.m.	
	3:29 p.m.	
	4:11 p.m.	
	4:58 p.m.	
	6:36 p.m.	+22.9


AIRCRAFT FLIGHT LINES
BOAT TRANSECTS
BOAT 1
BOAT 2
NOTE: Boat #1 transect and aircraft flight line 4 are colinear in part.
CORPORATE BOUNDARY
Kenai
Kenai Airport
Radio Towers
Radio Range Station
Sawmill
Wildwood Station
Storage Tanks
Radio Tower
KENAI RIVER
BEAVER LOOP ROAD
KENAI SPUR
KASILOF ROAD
Kalifonsky Beach
Salmo Rock
PIPELINE
(KENAI B-4)
(KENAI B-3)
SCALE 1:63360
4 MILES
21000 FEET
5 KILOMETERS
ROAD CLASSIFICATION
Medium-duty
Light-duty
INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D.C.—1973
KASILOF 12 MI.
SOLDOTNA 2 MI.
60°30'
151°07'30"

APPENDIX E

APPLICATION OF REMOTE SENSING DATA
TO LAND SELECTION AND MANAGEMENT ACTIVITIES

Kaltag Selection Area

Prepared by:
Dr. William Stringer, Geophysical Institute
Dr. Lewis Shapiro, Geophysical Institute
Dr. James Anderson, Institute of Arctic Biology

October 1974
Interim Report
Bureau of Indian Affairs
Contract No. E00C14201079
National Aeronautics and Space Administration
Grant No. NGL-02-001-092

Prepared for:
Bureau of Indian Affairs
National Aeronautics and Space Administration
Doyon, Ltd.

APPLICATION OF REMOTE SENSING DATA TO LAND SELECTION AND MANAGEMENT ACTIVITIES

Introduction

Currently the Alaskan regional Native corporations and villages are engaged in selection of lands authorized by the Alaska Native Land Claims Settlement Act. Among the criteria considered for lands selections are the potential for mineral and timber exploitation. The areas reserved for selection are vast and remote. Vegetation maps in existence generally do not denote commercial stands of timber. While mineralization prospecting and testing has been carried out over widespread areas of Alaska, maps of mineral prospecting areas do not exist -- partly because no need has arisen for maps of that nature. The time available for land selection is not sufficient for the production of vegetation and mineral prospecting area maps by conventional means. Furthermore, the cost of these products would be very great. In recent years, considerable attention has been given to the possibility of producing resource inventories by means of data gathered by earth-orbiting satellites.

The University of Alaska has been a major participant in the National Aeronautics and Space Administration's Earth Resources Technology Satellite (ERTS) program. This activity has acted to bring together scientists from many disciplines including ecology and geology to develop methods for applying satellite and aircraft remote sensing data to resource surveys in Alaska.

Representatives of the Doyon Regional Corporation approached the University of Alaska ERTS program to determine whether vegetation and mineral prospecting area maps could be produced for the lands available for selection by Doyon. The BIA was contacted for possible funding for a project of this nature. The BIA responded with a contract to the University of Alaska to produce such products for 250 townships in Doyon regional selection areas. This work was to be performed as a test of the feasibility of producing vegetation and mineral prospecting area maps for all Alaskan regional corporations.

This folio of materials for the Kaltag selection area contains a detailed vegetation map, a mineral prospecting area map, a composite map showing townships to be considered for potential commercial timber, Earth Resources Technology Satellite images of the selection area, and oblique aerial photographs obtained during an overflight of the test area.

The Kaltag Selection Area

This withdrawal area, located south of Kaltag (see map) along the Yukon River is relatively remote. There are no settlements along the Yukon for nearly 100 miles south of Kaltag. There are no roads to or within the area nor are there any airfields within it. During summer there is barge transportation available to either Nenana, on the Alaska Railroad, or to ocean-going shipping at the mouth of the Yukon. The closest airport is located at Kaltag.

The only known mineral extraction within the area consists of two coal mines which were operated early in the century. Logging, if any, was most likely limited to production of cord wood for steam-boats. Today it appears that the mineral potential is still largely un-explored and many fine stands of commercial-size spruce and hard-woods are found within the area.

Map of Alaska showing the Kaltag study area.

SUMMARY OF RECOMMENDATIONS

The first part of this report is a summary of the results of the analyses for mineral and forest product potential in the Kaltag selection area and the recommendations based on these results. It includes a map which shows only which townships in the selection area might be considered for mineral prospecting and for commercial timber development. Detailed descriptions of the analyses and the resulting thematic maps are presented in subsequent sections of the report.

SUMMARY OF RECOMMENDATIONS FOR FOREST PRODUCT POTENTIAL

In this analysis we have mapped areas of hardwood and softwood trees that appear sufficiently large to be generally considered commercial types when located near a market. This is not to say that these are commercial forests because that designation involves many economic factors not considered here. The areas designated here as commercial forest should be regarded as those stands of timber that have the greatest likelihood of being commercial forests.

No analysis has been made to determine timber volume charts for trees in this area. The nearest location of a study of that nature is along the Kuskokwim near Aniak.

As part of the Alaska Forest Inventory, aerial photographs were obtained along flight lines 30 miles apart over wide areas of Alaska including the Kaltag selection area. A small area on each photograph was analyzed by stereoscopic viewing. Occasionally, one of these samples was field-checked. These data, archived in Juneau, very likely represent the only ground-based investigation of the quality of trees in this area.

Before any selections are made on the basis of possible timber-related income, timber volumes should be established and an economic forester should be consulted to determine the economic feasibility of such a venture.

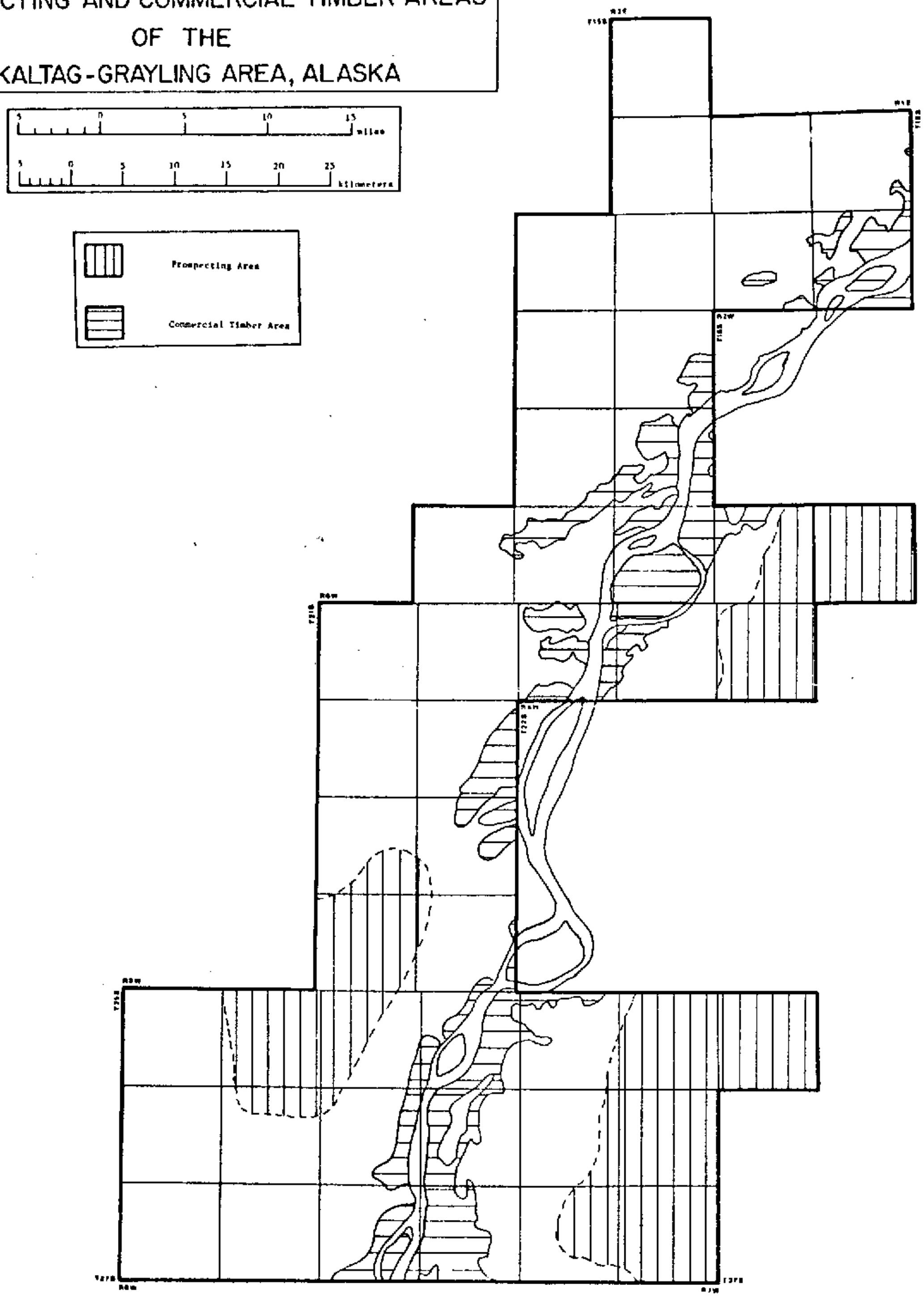
SUMMARY OF RECOMMENDATIONS FOR MINERAL POTENTIAL

Information presently available is not adequate for a preliminary evaluation of the mineral potential of the Kaltag-Grayling withdrawal area. Thus it is recommended that a program of field investigations be conducted during the next field season. This should consist of collection and analysis of about 500 stream sediment, soil and rock samples from the following localities:

1. Approximately 200 stream sediment, soil, and rock samples from the southern half of T. 26 S., R. 3 W., Kateel River Meridian, and adjacent areas, to determine the extent of the molybdenum mineralization discovered at the McLeod Prospect.
2. Approximagely 150-200 stream sediment samples from the Blackburn Hills to evaluate the mineral potential of the granitic rocks which underlie the area and their associated contact zones. The area of interest includes T. 24 S., R. 6 W.; T. 25 S., R. 7 W.; about 1/2 of T. 25 S., R. 6 W., Kateel River Meridian, and smaller parts of adjacent townships.
3. A reconnaissance stream sediment sampling program is recommended for the igneous and metamorphic terraine of T. 26 and 27 S., R. 3 W.; T. 25 S., R. 2 W.; T. 20 S., R. 1 W.; T. 21 S., R. 2 W.; Kateel River Meridian, and adjacent areas. A total of about 100 samples from these areas should be adequate.

All of the remaining area of this withdrawal should be eliminated from further consideration for selection as potential mineral lands.

PROSPECTING AND COMMERCIAL TIMBER AREAS
OF THE
KALTAG-GRAYLING AREA, ALASKA



PROVISIONAL LAND USE MAP OF THE KALTAG-GRAYLING AREA, ALASKA

Introduction

Land use maps of Alaskan areas are of increasing importance with the current widespread rush into land disposition and resource exploitation. Such maps provide a spatial and quantitative inventory of selected resources and some basis for sensible planning. Land use maps may help in organizing activities which would be compatible with (1) a natural environmental integrity and hence with regeneration potentials and esthetic qualities and (2) with the rational and long-range needs of the exploiting agency.

Land use maps where little land use, as such, has begun are particularly important. These tend to emphasize vegetation, the most visible and functionally important component of most ecosystems. The importance of vegetation includes its immediate resource values, such as timber and wildlife habitat, and its indicator values. Vegetation is an integrated expression of the history of the site and the nature of soils, drainage, permafrost, topography and small and large-scale climates.

The land use map of the Kaltag-Grayling area is the first of a series of maps of Alaskan areas of particular interest to the Bureau of Indian Affairs, the agency funding the mapping, and the Doyon Native Regional Corporation, within whose jurisdiction the map-area lies. It is essentially a vegetation map depicting broadly defined vegetation types at the relatively small scale, on the original, of 1:250,000.

Although limited in vegetation detail and scale, this map provides more information than any previous map and is a step toward the production of more meaningful land use maps of Alaska.

Approach

The map was drawn from Earth Resources Technology Satellite (ERTS) images. The reasons were (1) ERTS image availability, (2) the usefulness of ERTS imagery for mapping broadly defined vegetation types over large areas in a relatively short time and (3) lack of complete aerial photograph coverage.

The scenes used were numbers 1002-21321, 1038-21301, 1273-21370 and 1273-21373. Images for mapping were made as photographic prints enlarged to a scale of 1:250,000.

Two of the scenes, printed in black and white, were obtained in late winter, when the landscape was generally snow-covered, but when plants taller than the snow pack were free of snow. Images made from these scenes permitted determinations of vegetation structure, based on a gray scale continuum related to plant cover. Areas of no plant cover or of vegetation too low to show above the snow appeared nearly white. Areas of some plant cover appeared somewhat gray. Areas of intermediate plant cover appeared grayer, and areas of closed vegetation, where no snow showed, were dark gray. Briefly, nearly white was interpreted as tundra, intermediate gray as scrub or open forest, and dark gray as closed forest.

Two other scenes, obtained in the summer, were printed in color-infrared. These permitted gross floristic distinctions, based on some knowledge of the infrared reflectance of major species or species groups. Broad-leaved trees and shrubs reflect highly in the near infrared and therefore appear bright red on the imagery. Most needle-leaved species have low near infrared reflectance and therefore appear dark gray. Intermediate gray colors seem to indicate ericaceous shrubs.

The winter and summer images were used together in making the vegetation and other land use distinctions expressed in the classification system. Interpretations were further facilitated by physiographic information obtained from topographic maps, as there are some relationships between vegetation and physiography. For example, wetlands occur in low-lying flat areas; broad-leaved forests and forests dominated by white spruce are the main forest types on east, south and west slopes; and upland bogs and black spruce bog woodlands occur more frequently than the former on north slopes. Flood plains in the vicinity of streams commonly are occupied by white spruce and balsam poplar vegetation types containing trees of commercial grade.

Initially, most of the interpretations of the spectral units on the imagery were made through comparisons with aerial photographs covering parts of the map-area. Alaska Forest Inventory photographs in black and white modified infrared were obtained from the U.S. Forest Service, and some small-scale color-infrared photography was obtained from the National Aeronautics and Space Administration and its summer 1974 U-2

aerial photography mission. In general, more information is available on aerial photographs than is necessary for establishing or validating the broad land use classes recognizable on ERTS imagery.

The identification of vegetation containing trees of possible commercial timber grade involved the recognition of forest, then an estimation of forest composition and stature from the spectral and physiographic information described above. A quantitative definition of commercial timber is not intended. The commercial stands depicted on the map are those in which the occurrence of a number of larger trees suitable for lumber production is likely. White spruce, balsam poplar and paper birch are the potentially commercial grade species.

The mechanics of mapping included (1) tracing streams, lakes and other prominent landmarks onto a transparent plastic overlay of the base map, a U. S. Geological Survey topographic map, (2) positioning the overlay on the ERTS image according to these landmarks, (3) tracing identified spectral units onto the overlay, (4) positioning the base map over the overlay on a light table and (5) tracing the vegetation and other land use boundaries on the overlay onto the base map and labeling them.

A preliminary map was made in the laboratory by these methods, using all available control in the form of aerial photographs and written and oral information. This map was used as a guide to a route of travel by light aircraft for field checking. Comparing the preliminary map with certain parts of the map-area confirmed earlier

interpretations of the ERTS imagery in many cases, but showed also some faulty interpretations. This field work led to the revised and more nearly accurate map presented here.

The Map

The map depicts 11 land use classes which, in this case, are all vegetation types of rather broad definition. The classification system and symbolism is from the latest revision of A Land Use Classification System for use with Remote Sensor Data by James R. Anderson et al, U.S. Geological Survey, 1972-74. The distribution of units depicting vegetation containing trees of possible commercial grade is emphasized by crosshatching. The general composition of the vegeetation types is as follows:

3 2. Scrub. Scrub is a major physiognomic vegetation type, equivalent in rank to forest, bog, etc., dominated by shrubs or young, shrub-sized individuals of tree species. Much of the scrub in the map-area, particularly in the southeast, is believed to be the latter, chiefly post-fire stands of young aspen and birch. Closer to the Yukon River, however, scrub stands contain willows (Salix spp.) and alders (Alnus spp.) usually as dominants in flood plain and point bar early successional vegetation. Shrub dominated areas in bogs are not included, but fall within class 6 2, and high elevation shrub tundra is covered by class 8. Scrub is an important vegetation type for wildlife, especially large game animals, because of the high proportion in it of browse food material.

3 2 B. Recent burn. This designates an area recently burned by wildfire. Charred vegetation and downed trees occur in the area, and new herbaceous and shrub growth is widespread. The area will be increasingly valuable as wildlife habitat in the next few years.

4 1. Forest, broad-leaved. Forested areas are identified by a 4, and broad-leaved, usually deciduous forest by 4 1. Here the major species are paper birch (Betula papyrifera), aspen (Populus tremuloides) and balsam poplar (Populus balsamifera). Paper birch is the most widespread, occurring throughout the range of the broad-leaved forest type. Aspen is also widespread, but occurs mostly on more or less south facing slopes of moderate steepness. Balsam poplar is relatively limited, large trees occurring as stand dominants only on old flood plains in the vicinity of major streams. In the map-area, most broad-leaved forest is characterized by trees of small to intermediate size. Some of these may be important as pulp timber.

4 1 C. Broad-leaved forest, commercial. Broad-leaved forest believed to contain large trees of timber grade are designated by a C (commercial) and by crosshatching. These forests are mostly on the old flood plains in the vicinity of the Yukon River, and the principal species is balsam poplar. Some commercial broad-leaved forest stands on upland sites farther from the river are characterized by paper birch and some aspen.

4 2. Forest, needle-leaved. Needle-leaved, mostly evergreen forest, dominated by white spruce (Picea glauca) and/or black spruce (Picea mariana) is widely distributed in the map-area, but is considerably less

important areally than broad-leaved forest. White spruce is the dominant species on upland sites on most slopes. North slope needle-leaved forests are more often characterized by black spruce in closed and open stands. Needle-leaved forests on low-lying flat areas also are dominated more often by black spruce than white spruce.

4 2 C. Needle-leaved forest, commercial. White spruce is almost exclusive as the commercial grade dominant in commercial needle-leaved forests. Such forests are limited to the older flood plains, where white spruce forest usually follows broad-leaved forest as a late stage in vegetation succession.

4 3. Forest, mixed broad-leaved and needle-leaved. Most forest vegetation in the map-area is characterized by mixtures of broad-leaved and needle-leaved trees. This is a reflection of widespread heterogeneity in a number of environmental and historical factors. Mixed forest is by far the most important areally, but most of this is dominated by trees of intermediate size or, at higher elevations, by small trees. Some of this forest is open in nature, with low tree density and a correspondingly abundant shrub component. In general, therefore, mixed forest in the map-area may be of pulp value in some places and of value as habitat for large game animals in others.

4 3 C. Mixed forest, commercial. As mixed forest is the most important non-commercial forest type in the map-area, it is also the areally most important commercial type. Like the other two commercial types, it also is limited to lower elevation areas near the Yukon River.

Here the most important broad-leaved species is balsam poplar, but paper birch is widespread. Aspen is of some importance on sites somewhat removed from the river. White spruce is the only important needle-leaved component.

6 1. Wetland, forested. A 6 designates wetland, a broad class of vegetation and land use types generally characterized by a soil water table at or near the surface most of the year. A 6 1 designates wetland areas where the water table is just low enough to allow some tree growth. In the map-area, this growth is characterized by black spruce and some paper birch. Trees are small to intermediate in size, and their density is low. Hence the vegetation is mostly open forest and, where tree density is even lower, woodland. In the latter, which is the areally most important in the forested wetland class, a bog woodland, specifically a black spruce bog woodland, is involved. The bog components comprise shrub and dwarf-shrub layers and a thick cryptogam layer. Shrubs are several ericaceous species, shrub birch (*Betula glandulosa*) and some willows. The cryptogam layer is made up of several moss species, and some *Sphagnum* spp. and lichens. Herbs are widespread but of relatively low density.

6 2. Wetland, non-forested. Some non-forested wetlands are similar to the preceding, but lack trees. Dwarf-shrub, herbaceous and cryptogam vegetation is dominant. The herbaceous component includes much cottongrass (*Eriophorum* spp.) and sedge (*Carex* spp.). The cryptogam component is characterized by a higher proportion of *Sphagnum* spp. than the equivalent forested wetland component.

This type is known as bog or, colloquially, muskeg, and is further characterized by the slow and possibly intermittent accumulation of peat. This accumulation leads to cold soils and near-surface permafrost development.

Another kind of vegetation in the non-forested wetland class is marsh, characterized by a thoroughly wet soil, with the water table above the surface, and a vegetation of graminoids and bryophytes. Sedges and several grass species are characteristic. In the map-area, stands designated 6 2 located near small, slow-flowing streams, ponds and lakes in flat areas are more often marsh than bog.

8. Tundra. Higher elevation areas, generally above approximately 2,500 feet, are occupied by tundra, a broad landscape category characterized by at least four major physiognomic vegetation types. These are scrub, dwarf-scrub, meadow and fellfield. These types were not distinguished in the Kaltag-Grayling map-area.

An example of a use to which a map of this kind can be put is the compilation of townships within which stands of commercial timber occur. Here is a list of these, all on the Kateel River meridian:

Nulato Quadrangle

R1E: T15S, T16S, T17S

R1W: T16S, T17S

R2W: T17S

C~2

Ophir Quadrangle

R1E: T17S, T18S

R1W: T17S, T18S

R2W: T17S, T18S, T19S

Unalakleet Quadrangle

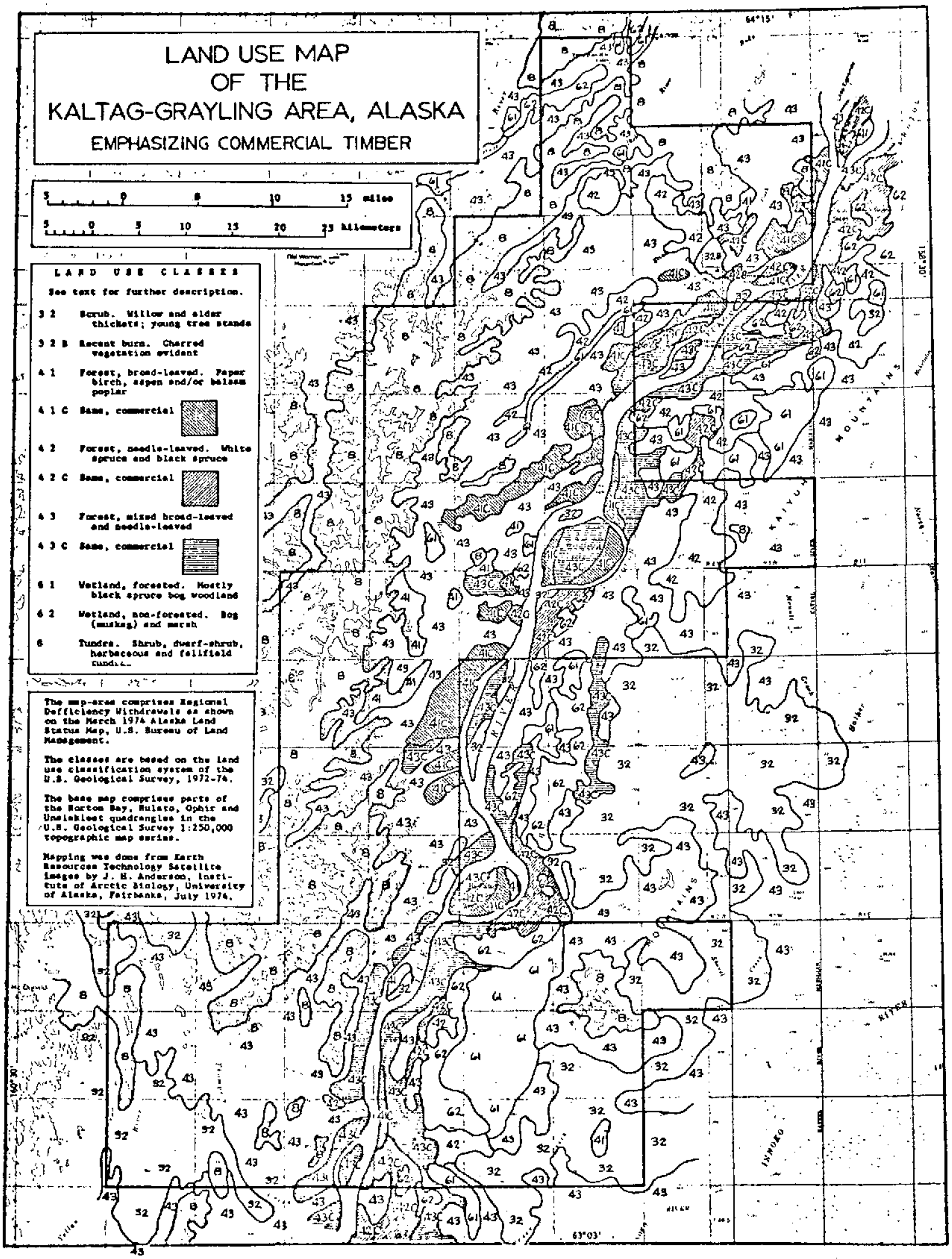
R2W: T17S, T18S, T19S, T20S

R3W: T18S, T19S, T20S, T21S, T22S, T23S, T24S

R4W: T19S, T20S, T21S, T22S, T23S, T24S, T25S

R5W: T22S, T23S, T24S, T25S, T26S, T27S, T28S

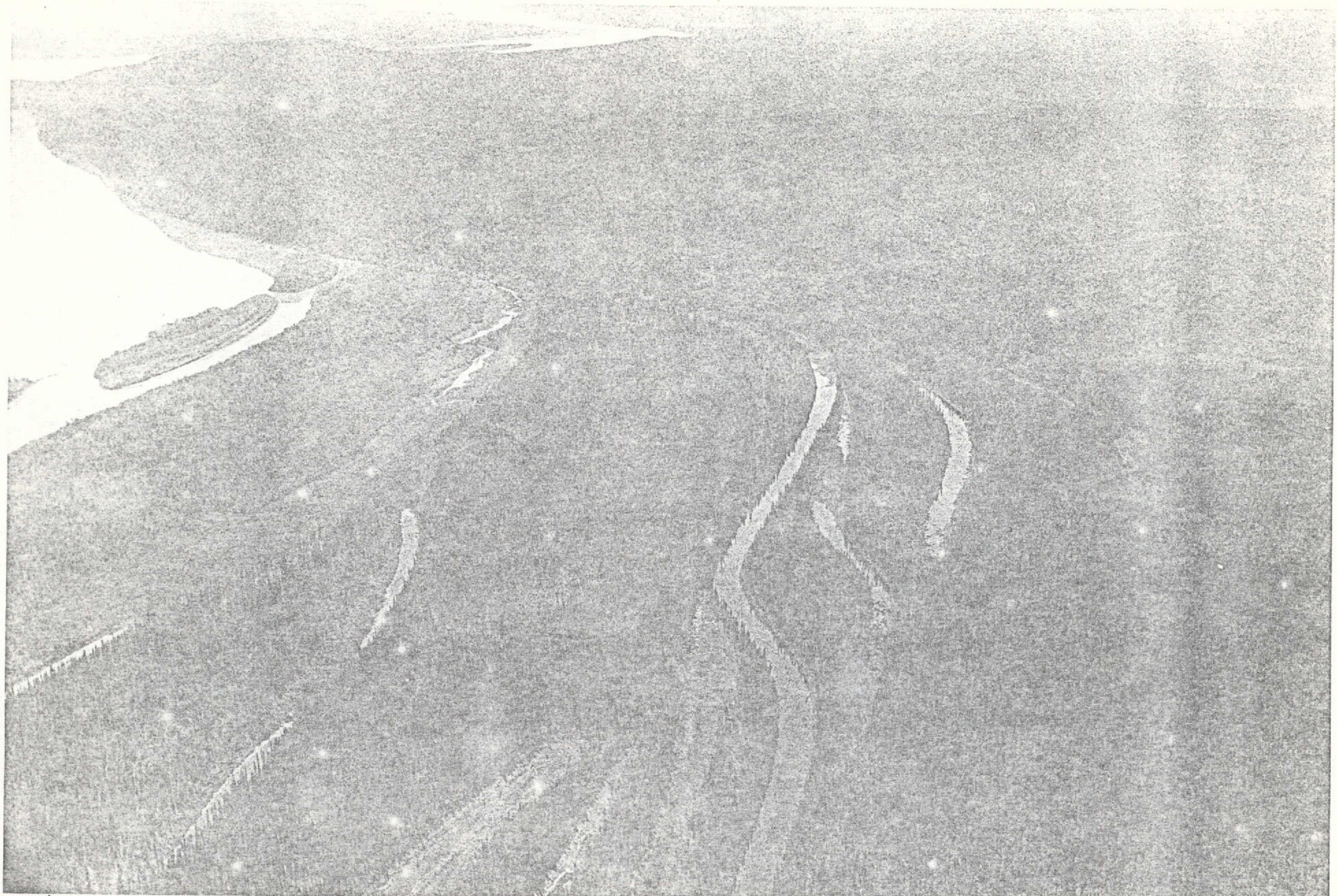
R6W: T26S, T27S, T28S


LAND USE MAP
OF THE
KALTAG-GRAYLING AREA, ALASKA
EMPHASIZING COMMERCIAL TIMBER
5 0 5 10 15 miles
5 0 5 10 15 20 25 kilometers
LAND USE CLASSES
See text for further description.
3 2 Scrub. Willow and alder thickets; young tree stands
3 2 B Recent burn. Charred vegetation evident
4 1 Forest, broad-leaved. Paper birch, aspen and/or balsam poplar
4 1 C Same, commercial
4 2 Forest, needle-leaved. White spruce and black spruce
4 2 C Same, commercial
4 3 Forest, mixed broad-leaved and needle-leaved
4 3 C Same, commercial
6 1 Wetland, forested. Mostly black spruce bog woodland
6 2 Wetland, non-forested. Bog (muskeg) and marsh
8 Tundra. Shrub, dwarf-shrub, herbaceous and fellfield tundra
The map-area comprises Regional Defficiency Withdrawals as shown on the March 1974 Alaska Land Status Map, U.S. Bureau of Land Management.
The classes are based on the land use classification system of the U.S. Geological Survey, 1972-74.
The base map comprises parts of the Norton Bay, Nulato, Ophir and Unalakleet quadrangles in the U.S. Geological Survey 1:250,000 topographic map series.
Mapping was done from Earth Resources Technology Satellite images by J. H. Anderson, Institute of Arctic Biology, University of Alaska, Fairbanks, July 1974.
MOUNTAINS
KAIYUH

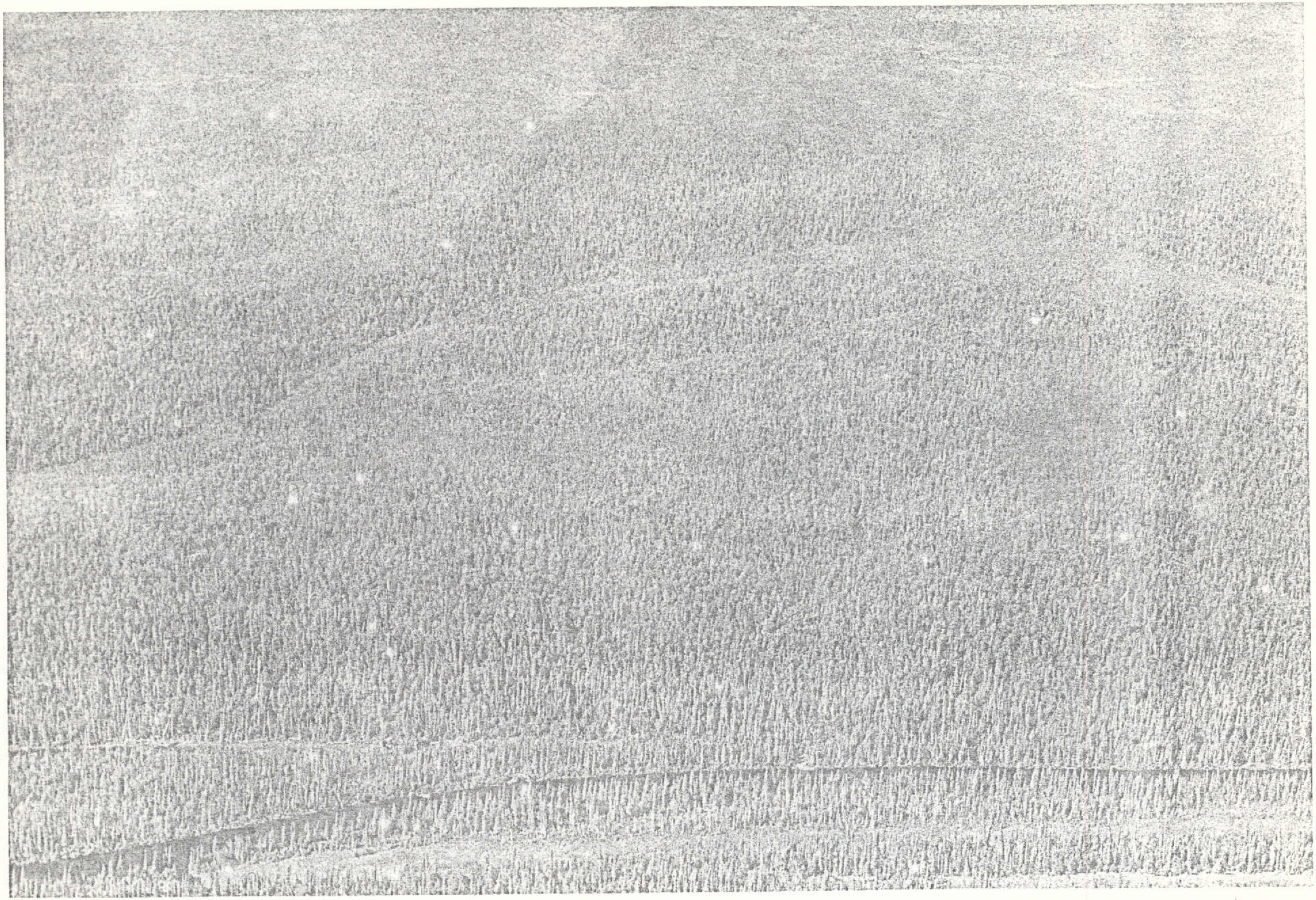
Oblique Aerial Photography

A field check of preliminary versions of the maps presented in this folio was made by light aircraft August 5, 1974. At that time several oblique 35mm photographs were taken for the purpose of illustration. These photographs were taken under varying lighting conditions through the plexiglass windows of the aircraft which resulted in some loss of quality. The location of each photograph is indicated on the copy of the vegetation map included here. The following paragraphs describe each photograph:

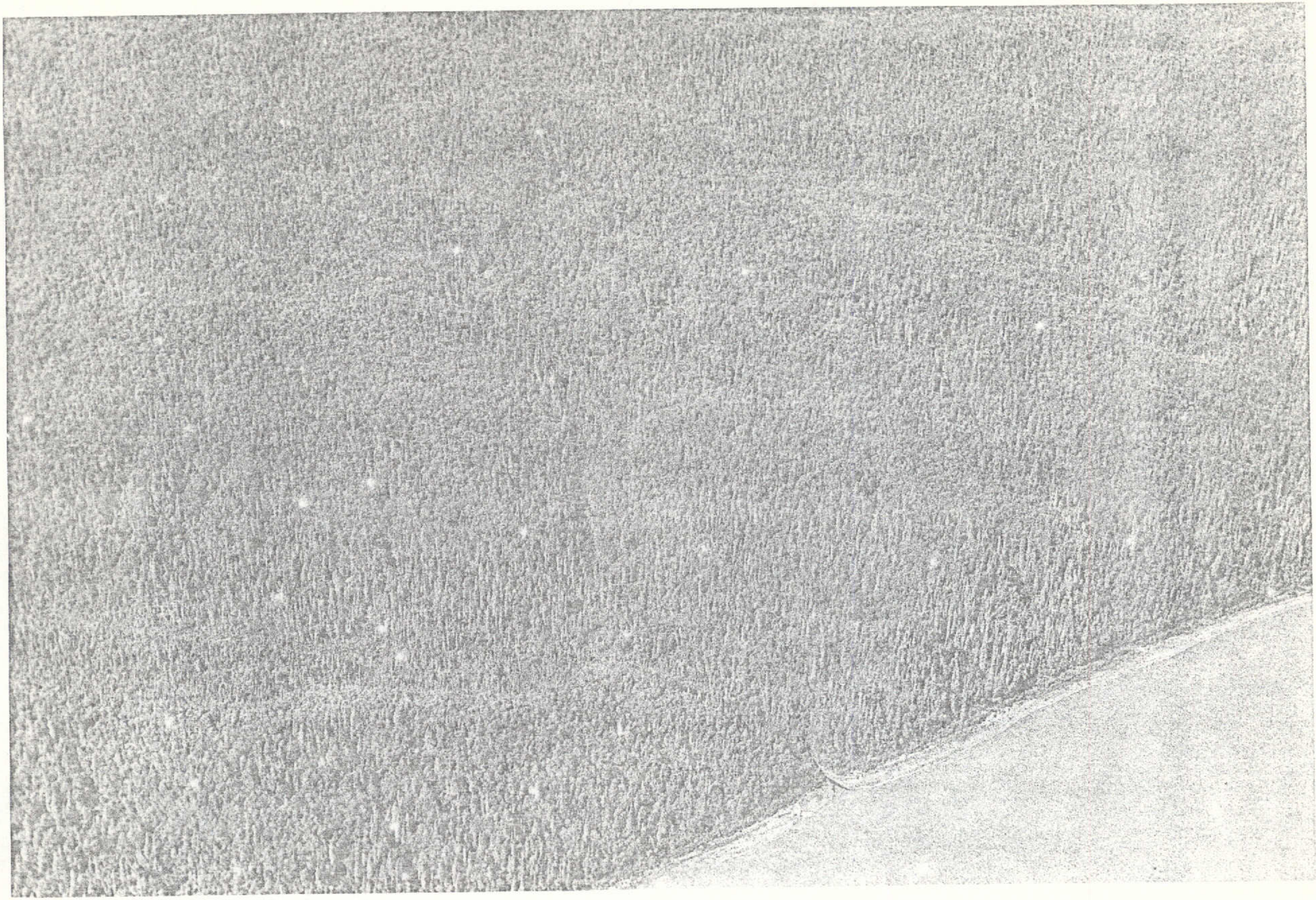
1. This photograph was taken looking downriver. Steamboat slough is in the foreground. The photograph looks over an area described as mixed broad-leaved and needle-leaved trees of commercial size.
2. This photograph was taken while over the Yukon river looking west just downriver from the previous picture. Here also the timber was characterized as mixed, commercial grade trees.
3. This photograph was taken while over the Yukon river looking west. Although judged to be dominantly commercial-sized broad-leaved trees, some needle-leaved trees of commercial size can also be seen.
4. This photograph is characteristic of the mixed forest on the west side of the Yukon river just opposite Alice Island. Stands of commercial mixed forest lie to either side of this photograph.
5. This photograph shows the stand of commercial-sized needle-leaved trees located just east of the Yukon river at the southern side of the selection area.



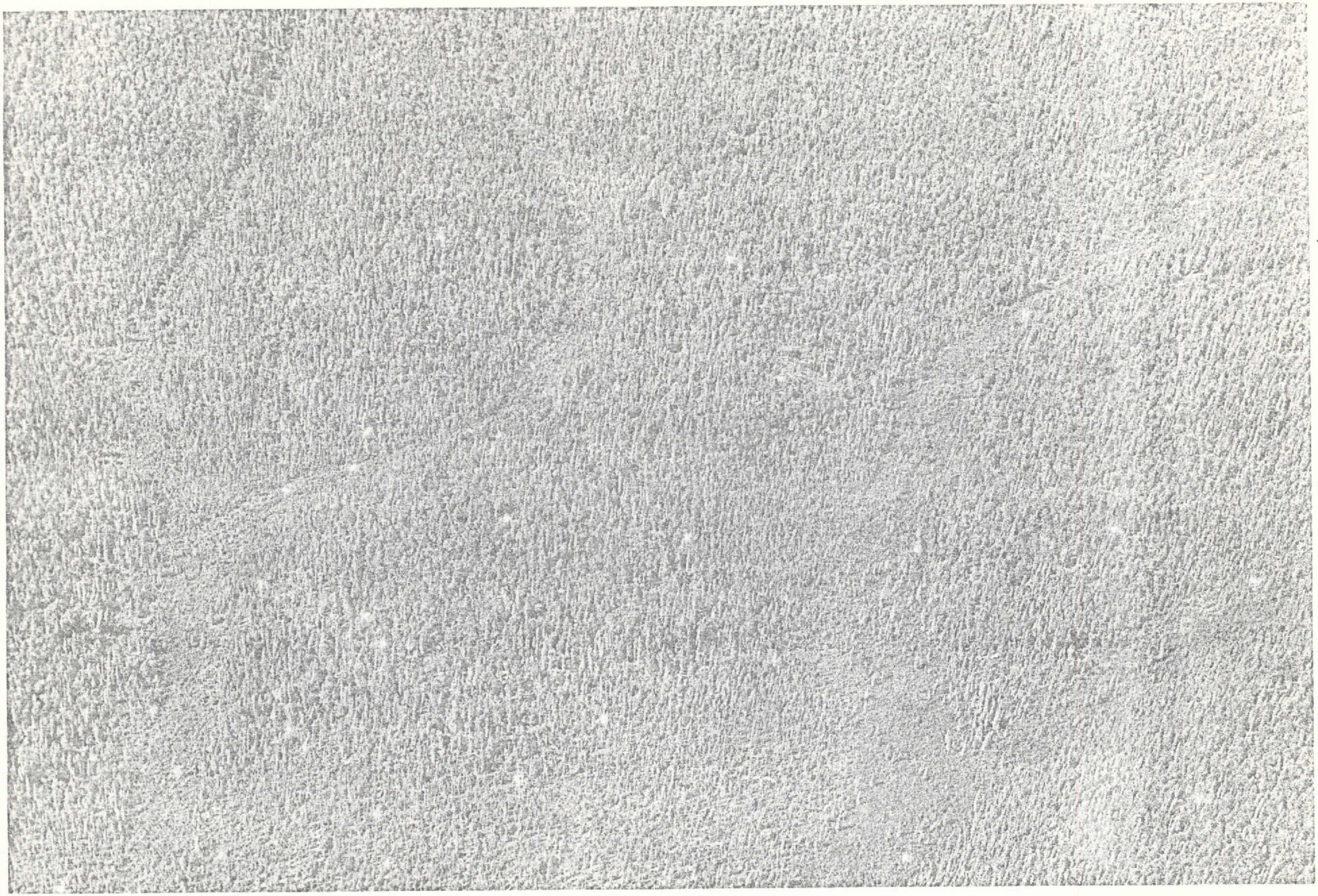
1. This photograph was taken looking downriver. Steamboat slough is in the foreground. The photograph looks over an area described as mixed broad-leaved and needle-leaved trees of commercial size.



2. This photograph was taken while over the Yukon river looking west just downriver from the previous picture. Here also the timber was characterized as mixed, commercial grade trees.



3. This photograph was taken while over the Yukon river looking west. Although judged to be dominantly commercial-sized broad-leaved trees, some needle-leaved trees of commercial size can also be seen.



4. This photograph is characteristic of the mixed forest on the west side of the Yukon river just opposite Alice Island. Stands of commercial mixed forest lie to either side of this photograph.

5. This photograph shows the stand of commercial-sized needle-leaved trees located just east of the Yukon river at the southern side of the selection area.

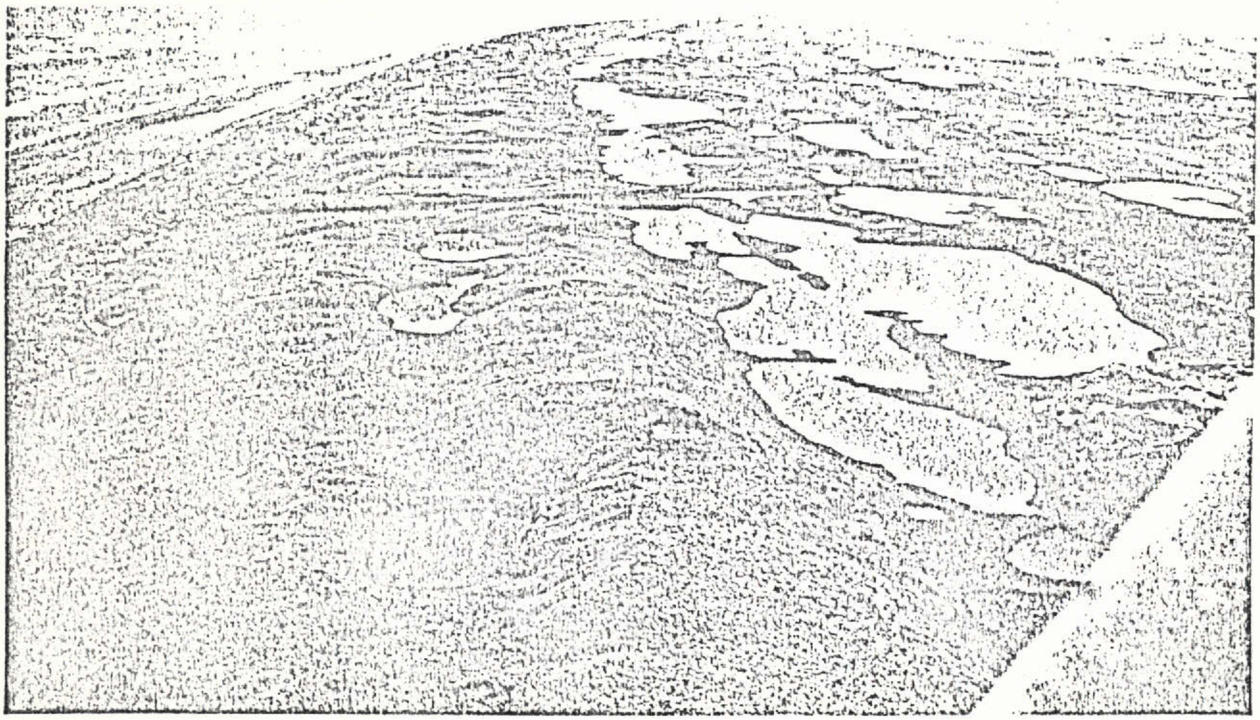


Figure 4. Low altitude aerial view eastward over the beach ridge zone at Cape Espenberg.

I. Introduction

The study area includes 47 townships along the Yukon River between the villages of Kaltag and Grayling. The river flows generally north to south through the area, with a low flood plain up to 12 miles wide extending eastward to the southwest extension of the Kaiyuh Mountains. West of the river, the topography is more rugged, with a relief of up to 1000 feet within a few miles of the river, and virtually no flood plain. Vegetation cover is almost complete, with the exception of a few hilltops in the Blackburn Hills.

A brief summary of the geology of the region is given in U. S. Geological Survey Open-File Report # 546 titled "Status of Mineral resource information on the major land withdrawals of the Alaska Native Claims Settlement Act of 1971." This is stated simply as "The geologic terraine is made up of Cretaceous sedimentary and Cretaceous and Tertiary volcanic and hypabyssal intrusive rocks. A small granitic pluton occurs in the Blackburn Hills". Mapping of the part of the withdrawal in the Norton Bay and Nulato quadrangles is complete though, as yet, unpublished. Descriptions of some of the rock units which crop out in the area are given in Mertie (1937) and Cass (1959 a,b,c). No geochemical data are available for any part of the withdrawal. As stated in Open-File Report # 546, data for preliminary appraisal of the mineral resource potential of the area is considered to be inadequate, although the potential for mineral deposits in the northern part of the withdrawal is considered to be low, based on the nature of the surface rocks.

Brief reports on the geology of known coal resources in the area are given in Mertie (1937) and Barnes (1967). Descriptions and locations of lode and placer deposits of base and precious metals are given in Cobb (1968). No data are available regarding the possible presence of non-metallic mineral resources or sand and gravel deposits.

The only known occurrence of sulfide mineralization with the withdrawal area is the McLeod prospect, located on the line between T. 25 S. and T. 26 S., R. 3 W. in the Unalakleet 1:250,000 quadrangle map. Samples of molybdenum sulfide minerals in vein quartz, associated with rhyolite prophyry, probably collected from this locality, were described by Mertie (1937). The prospect was opened in 1942 by a series of shallow trenches through the four feet of overburden which covers the area but the results of this work are not known. A U. S. Geological Survey field party visited the site in 1945 as part of an exploration program for radioactive minerals. Results of this work were negative (West, 1954). An analysis of heavy mineral separations from one sample each of the rhyolite porphyry and vein quartz indicated the presence of pyrite, pyrrhotite and oxides and sulfides of molybdenum. No further work is known from the prospect since that time.

Few mineral prospects are known from areas adjacent to the withdrawal area. In about 1900 placer claims were located along the Anvik and (probably) Yellow Rivers which drain part of the Blackburn Hills, but there is no record of any production from these. A single lode claim was staked on the Rado River, a few miles from Kaltag, but

nothing further is known about this property. Occurrence of base and precious metals are known from several localities in the Kaiyuh Mountains, but none are within thirty miles of the withdrawal.

Two coal mines operated within the withdrawal area in the years prior to 1903, for the purpose of supplying coal to river steamers. A few hundred tons of coal were produced for this purpose. Available information indicates that reserves at both mines are too small to be worth further considerations at this time.

II. Procedures

The general lack of availability of geologic and geochemical data from this area precludes the possibility that any evaluation of the mineral potential can be prepared at present. Thus, this study was conducted with the objectives of answering two questions. First, based upon information which could be developed from study of available data, plus ERTS-1 imagery, which areas can be eliminated from consideration as possible mineral provinces? Second, what geologic field studies are required to evaluate the mineral potential of the remaining area?

The ERTS imagery of the area which was available at the time the study was done was not optimum, although useful results were obtained. As noted above, the entire area is heavily covered by vegetation, which tends to detract from the utility of the imagery for geologic studies. It would have been desirable to have imagery which was acquired during the spring or fall when snow cover was absent or mini-

mal and vegetation was not well-developed. Unfortunately, no such imagery is available at present, but if it is acquired prior to the termination of the project, it will be examined, and the report revised if necessary.

The utility of the ERTS imagery to the present problem depends upon the accuracy with which the nature of bedrock can be deduced from the imagery. The minimal ground truth available for the area is generally adequate for the purpose of providing criteria for identification of general bedrock types.

Alluvium filled valleys and flood plains are easily recognized on the ERTS imagery by interpretation of vegetation patterns and identification of characteristic topographic features such as old meander loops, which are typical of flood plain deposits. The area underlain by Cretaceous sedimentary rocks is defined by a well-developed trellis drainage pattern in which the longer drainages probably indicate the strike of the structural grain. The presence of igneous rocks is indicated by two means. First, interruptions in the trellis drainage pattern, by local radial drainages around topographic domes (in particular), are taken as implying the possible presence of igneous intrusive bodies. Second, the boundaries of the granitic plution in the Blackburn Hills, which was noted above, are recognizable by interpretation of tonal differences between bands of the ERTS imagery, because the higher hills, in which the granite occurs, are not covered by vegetation. Finally, areas of probable mixed igneous and metamorphic

rocks in the eastern and southeastern parts of the withdrawal were identified as topographic extensions of the Kaiyuh Mountains to the northeast.

Based on the above criteria and known geologic information regarding the area, the withdrawal can be mapped into six categories for the purpose of classification into prospecting areas. These are (see map):

1. Alluvium covered areas along the Yukon River and some of its tributaries, where bedrock is not visible at the surface.

2. Areas in which the surface rocks consist primarily of sedimentary rocks of Cretaceous age.

3. A terraine of probably mixed igneous and sedimentary rocks in the northern part of the withdrawal area.

4. The area of assumed mixed igneous and metamorphic rocks of the Kaiyuh Mountains.

5. The outcrop of granitic rocks in the southwestern part of the withdrawal area, which includes the stock noted above, and numerous adjacent igneous bodies which are assumed to be dikes radiating from the stock.

6. A part of the Kaiyuh Mountains in the southeastern part of the withdrawal, consisting of a topographic dome, with the McLeod prospect near its summit.

III. Discussion and recommendations

As noted in the introduction, there is not sufficient information available in the form of geologic maps and geochemical sampling, to prepare a preliminary evaluation of the potential of this withdrawal for the occurrence of base or precious metal deposits. As a result,

there is no basis for recommending selection of specific townships at this time. Instead, it is considered advisable that, prior to selection, an attempt be made to acquire additional information upon which a choice can be based. The present study has been focused on eliminating areas in which such investigations can reasonably be expected to yield negative results (particularly in view of the time limitations on the selection process), and to establish a schedule of priorities for additional field work in those areas where the surface rocks indicate the possibility of discovering metallic mineral deposits. Some recommendations as to the nature of this field work are discussed below. It should be emphasized that the suggested work will not define or indicate the presence of commercial orebodies. Instead, it will serve only to delineate areas which merit additional study. It is assumed that such work would be done by an interested mining organization under some agreement with Doyon.

The approach adopted here has been to identify areas in which the surface rocks are dominantly igneous or metamorphic, because these are most likely to contain deposits of metallic minerals. The character of these areas, in terms of topography and extent of outcrop, was determined from study of available maps, ERTS imagery, and observations during a light aircraft flight over the entire withdrawal area. A review of the literature provided data on previous mining or prospecting activity in the area. The results suggest the following actions:

1. Areas covered by flood plain or other alluvial deposits

should be eliminated from further consideration because no information is presently available regarding the nature of bedrock underlying these deposits, and none is likely to be developed prior to the selection deadline.

2. That part of the withdrawal where the surface rocks are Cretaceous sedimentary rocks is considered to have low potential for the occurrence of metallic mineral deposits, except possibly in the area around Blackburn Hills where it is in contact with granitic intrusive rocks. As noted, coal deposits are present in the sedimentary rock section, but information presently available indicates that the potential for commercial production of coal is low. Further, additional work, including detailed geologic mapping would be required to thoroughly evaluate the coal resource, and it would not be possible to accomplish this in the time available.

3. The geology of the northern part of the withdrawal (those townships which lie in the Norton Bay and Nulato quadrangles) has been mapped and the results indicate a low potential for the occurrence of ore deposits. The area should thus be eliminated from consideration.

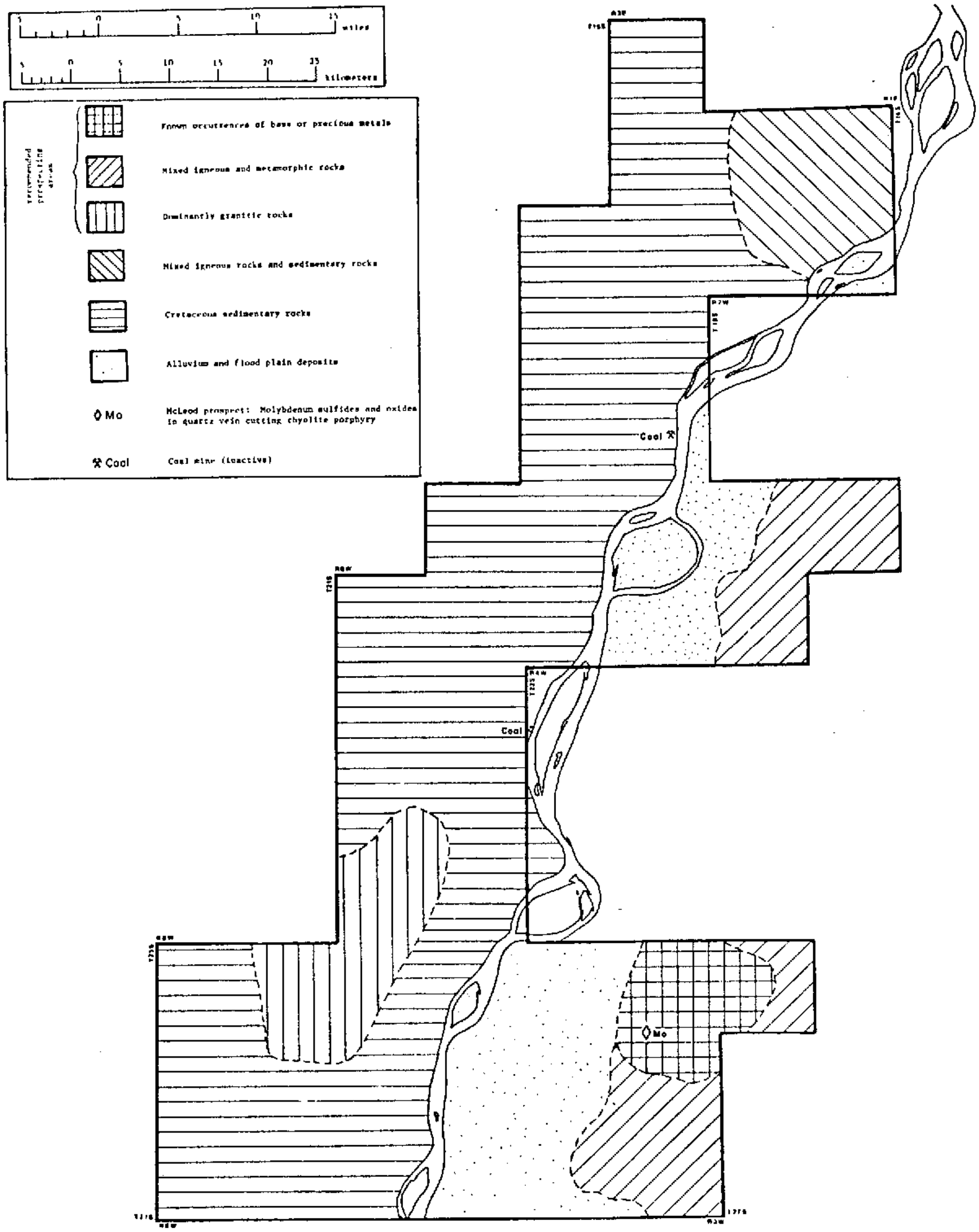
4. The Blackburn Hills in the southwestern part of the withdrawal merit further work. As noted above, the area is dominated by granitic rocks, including a stock and possibly dikes radiating away from it. Both these rocks, and the zones where they are in

contact with the adjacent sedimentary rocks, are potential hosts for mineralization. The topography of the area and the absence of vegetation indicate that a modest stream sediment sampling program would provide adequate information for a preliminary appraisal of the mineral potential of the area. It is recommended that such a program be instituted during the next field season. A total of about 150 to 200 samples would be required.

5. That part of the withdrawal which is underlain by the rocks of the Kaiyuh Mountains has been subdivided into two areas on the map. One of these, as noted above, is the topographic dome which includes the McLeod prospect near its summit. The occurrence of molybdenum minerals in quartz veins, and in association with rhyolite prophyry as the host rock is suggestive of the possible presence of a deposite of low-grade copper and/or molybdenum ores. As a result, it is recommended that a program of stream sediment, soil and rock sampling be conducted in the area during the coming field season. It is important to define the approximate geometry of the rhyolite porphyry mass, and to determine whether or not it is mineralized other than at the site of the McLeod prospect. Such a program would require about 200 soil and stream sediment samples to be collected and analyzed, plus examination of outcrops and analysis of rock samples collected from these.

6. The remaining area underlain by the rocks of the Kaiyuh Mountains also merits further study. In this case, about 100 stream sediment samples should be adequate for a preliminary evaluation.

PROSPECTING AREAS OF THE KALTAG-GRAYLING AREA, ALASKA



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APPENDIX F

PRELIMINARY VEGETATION MAP OF THE ESPENBERG PENINSULA, ALASKA, BASED ON AN EARTH RESOURCES TECHNOLOGY SATELLITE IMAGE*

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Vegetation maps are useful in several scientific and applied areas (Küchler 1953, 1967b: 307-396, 1973; J. H. Anderson et al 1973: 70). Of concern here is the possible usefulness of a vegetation map as (a) an inventory of plant communities and the landscape units and ecosystems they represent, or a product resembling Küchler's (1973: 512) "...tangible, integrated expression of the biogeocenose.," (b) a reservoir of basic information with which future environmental changes may be ascertained and evaluated, (c) a primary tool for land use planning and management, and (d) a guide to future and more thorough research.

The Earth Resources Technology Satellite-1, ERTS-1, has been a source of imagery depicting vegetation and other earth surface features since its launch by the United States National Aeronautics and Space Administration into a near-polar, sun synchronous orbit on July 23, 1972. The potential

*This work was funded in part by NASA Grant NGL 02-001-092.

role of ERTS imagery in the analysis, description, classification and mapping of vegetation in Alaska is currently under study, and early results include several maps and otherwise show promise for vegetation science (Anderson 1973b, 1974; Anderson and Belon 1973; D. M. Anderson et al 1973; J. H. Anderson et al 1973).

A preliminary vegetation map of the Espenberg Peninsula in the Chukchi-Imuruk Biological Survey region on Alaska's Seward Peninsula, under study by the U. S. National Park Service, was made because of its possible uses as enumerated above, the availability of good ERTS imagery and the availability of results of the 1973 field Survey for use in interpreting the imagery (Fig. 1). The rest of the Survey region is covered by ERTS imagery, but this imagery is less suitable for vegetation mapping because of cloudiness or unfavorable season. However, this imagery is of sufficient quality to justify an attempt to map certain other places, such as the Imuruk Lake area, and it is possible that additional imagery of the highest quality for the Survey region will be obtained in the future.

The map here presented (Fig. 3) is preliminary pending (a) further ground control over the identification and delineation of units, (b) subdivision of the larger units to make the map more thoroughly informative regarding the distribution of plant communities, (c) augmentation and possible refinement of the map unit classification, (d) an accuracy analysis using aerial photographs and other information not yet acquired and (e) critical review by phytocenologists and land use personnel.

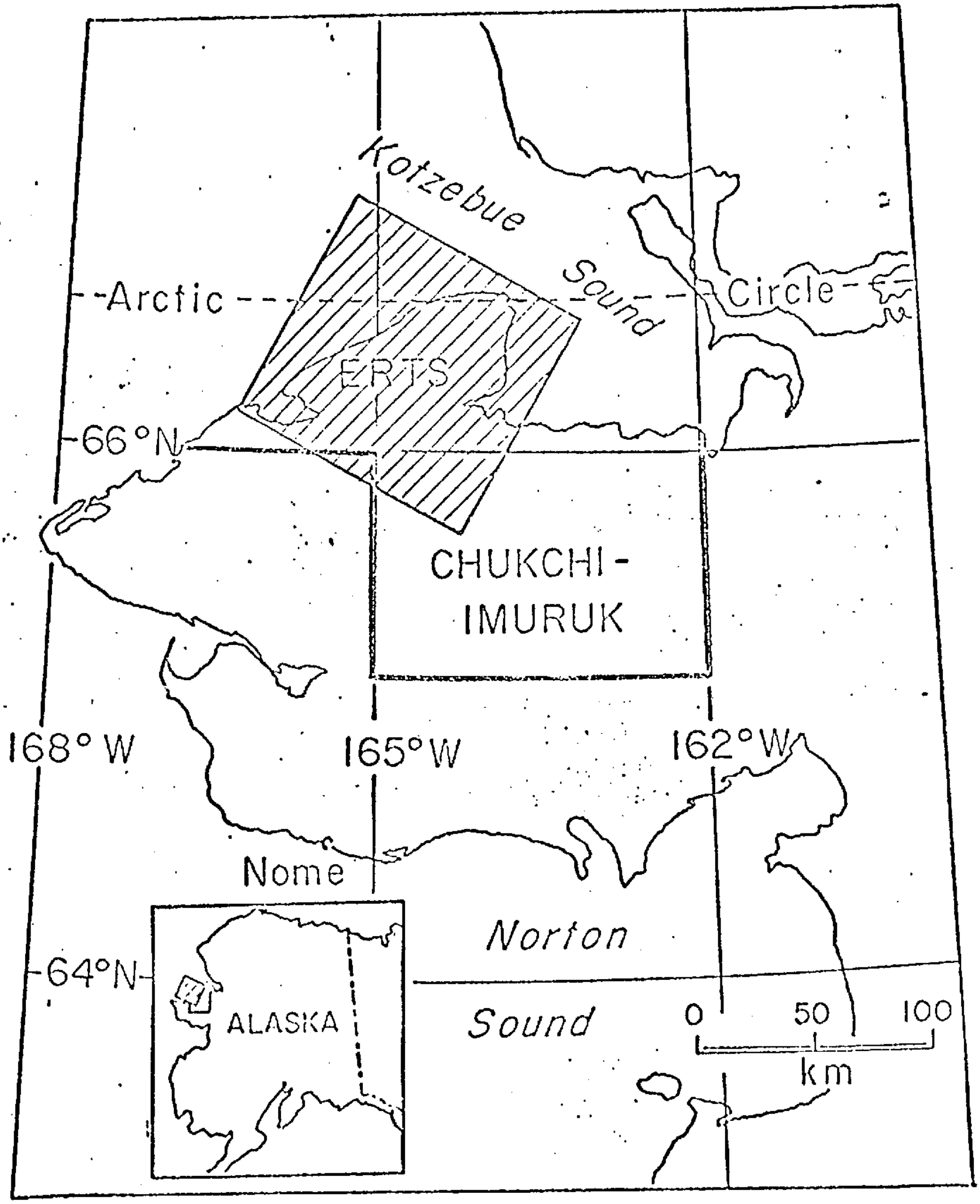

Figure 1. Location of the Chukchi-Imuruk Biological Survey, ERTS-1 scene 1009-22092, and the Espenberg Peninsula map-area, the latter being the land area of the scene.

Previous Work

The earliest known vegetation map of the Espenberg Peninsula is a sketch map by Collier (1908: 55) covering the whole Seward Peninsula. This map, at a scale of approximately 1:4,800,000, shows three broad vegetation types and the western limit of spruce timber. Most of the Espenberg Peninsula is mapped as "Tundras; Willows and Grass Along Watercourses." The southeastern approximately one third of the map-area is mapped as "Timberless Uplands; Willows and Grass Along Watercourses." Collier's third map unit, "Timbered Areas, with Scattering Growth of Spruce," is limited to the eastern and southeastern parts of the Chukchi-Imuruk Biological Survey area, some distance from the Espenberg Peninsula.

Sigafoos (1958a) authored a 1:500,000 scale vegetation map of the Seward Peninsula. Regarding the Espenberg Peninsula, this map is similar to Collier's in showing an unbroken "Wet Tundra" over most of the area, with "Wet Tundra Willows" in the southeast. In addition, it shows several units of "Dry Tundra" in the beach ridge zone of the northern and northwestern coast, around Devil Mountain, and around Serpentine Hot Springs. Also shown are several units of "Coastal Marsh," notably adjacent to the eastern end of Shishmaref Inlet. Two other map unit classes, "Shrub Tundra" and "Open Spruce Forest," are absent from the Espenberg Peninsula map-area but occur in the eastern and southeastern parts of the Survey area (Fig. 1). Sigafoos' map is based on a substantial amount of botanically oriented field work and seems to give a good idea of the general distribution of major vegetation types, a conclusion based on

comparisons with later maps and the new one presented here. However, the level of information on Sigafoos' map is coarse, and the map suffers from the spatial and topographic inaccuracies of the 1913 base map that he used.

Another map by Sigafoos (1958b), at a scale of 1:2,500,000, depicts vegetation types only roughly comparable classificatorially and spatially with those of the preceding map. Most of the Espenberg Peninsula is shown covered by "Herbaceous Tundra." The northern and northwestern coastal strip is mapped under the unit class "Rock Desert, Sand Plains, and Bare Rock," as are the highlands around Serpentine Hot Springs. "Shrub Tundra" is shown around Devil Mountain, along the lower Serpentine River and in the vicinity of Serpentine Hot Springs.

Spetzman (1963) authored a 1:2,500,000 scale Alaska vegetation map showing the general distribution of nine major vegetation types, four of which are shown on the Espenberg Peninsula: "High Brush," of minor occurrence in the southeast; "Moist Tundra;" "Wet Tundra and Coastal Marsh;" and "Barren and Sparse Dry Tundra." These appear to be approximately the equivalents of three of Sigafoos' (1958a) units, his "Wet Tundra Willows;" "Dry Tundra;" "Wet Tundra;" and, again, "Dry Tundra" respectively. Spetzman's map is approximately as detailed as Sigafoos' with respect to the distribution of vegetation types in spite of its smaller scale. There are a few discrepancies between the two maps resulting in some uncertainty as to which is the more representative.

Spetzman also mapped vegetation on U. S. Geological Survey topographic maps in the 1:250,000 series using the same nine map unit classes as on his Alaska State map. The value of these maps lies in their providing more

detailed information on the distribution of the vegetation types represented. The detail nevertheless is coarse relative to the map scale. These maps are unpublished except for transparent plastic overlays made from them, recently available through the Joint Federal-State Land Use Planning Commission for Alaska in Anchorage, to be used in conjunction with U. S. Geological Survey maps.

Küchler's (1967a) map of potential natural vegetation of Alaska at a scale of 1:7,500,000 depicts "Cottonsedge Tundra (<u>Eriophorum</u>)" and "Watersedge Tundra (<u>Carex</u>)" on the Espenberg Peninsula. The former occurs in a large unit around the Devil Mountain and Kileak Lakes. The latter is continuous throughout the rest of the area.

Hutchison's (1967) Alaska forest map shows "Non-Forest" on the Espenberg Peninsula and most of the Chukchi-Imuruk Biological Survey region.

Viereck (in Viereck and Little 1972) published an Alaska vegetation map which is for the most part a condensation of Spetzman's (1963) map with some revisions based on its author's abundant firsthand knowledge of Alaska vegetation. However, at one half the scale, 1:5,000,000, it is necessarily less informative than Spetzman's map regarding the distribution of vegetation types. It is curious that the northern and northwestern coastal strip of the Espenberg Peninsula, mapped appropriately enough under "Barren and Sparse Dry Tundra" by Spetzman, is mapped by Viereck as "Alpine Tundra."

In 1973 the Joint Federal-State Land Use Planning Commission for Alaska published a 1:2,500,000 scale map, <u>Major Ecosystems of Alaska</u>, which

appears to be a copy of Spetzman's map except for its incorporating the revisions of Viereck's map and its featuring an ecosystem oriented terminology. "Moist Tundra" and "Wet Tundra" ecosystems are shown in the Espenberg Peninsula map-area. The alpine tundra term applied on Viereck's map was retained here.

Anderson and Belon (1973) produced an ERTS image-based vegetation map of the western Seward Peninsula, one of the first maps of this type. This map overlaps the Espenberg Peninsula map-area and is presented here, slightly modified to show the extent of overlap (Fig. 2) and to incorporate some refinement in the map unit classification. The chief contribution of this map beyond the more useful previous maps, i.e. those of Sigafoos (1958a) and Spetzman (1963), is its showing more spatial information for previously defined vegetation types through use of geographically smaller units and several mosaic classes. In addition it shows the distribution of a new vegetation type, possibly a grassland tundra (class 7), and two ephemeral features, fire scars (class 4) and senescent vegetation (class 5).

Perhaps some vegetation or quasi-vegetation maps were produced for various publications or limited-distribution reports dealing with reindeer-caribou management on the Seward Peninsula, although J. R. Luick, an authority on this subject (personal communication 1974), knew of none. No search was made for such maps, but it is unlikely that, with the possible exception of local areas, these would be more informative than some of the maps reviewed above.

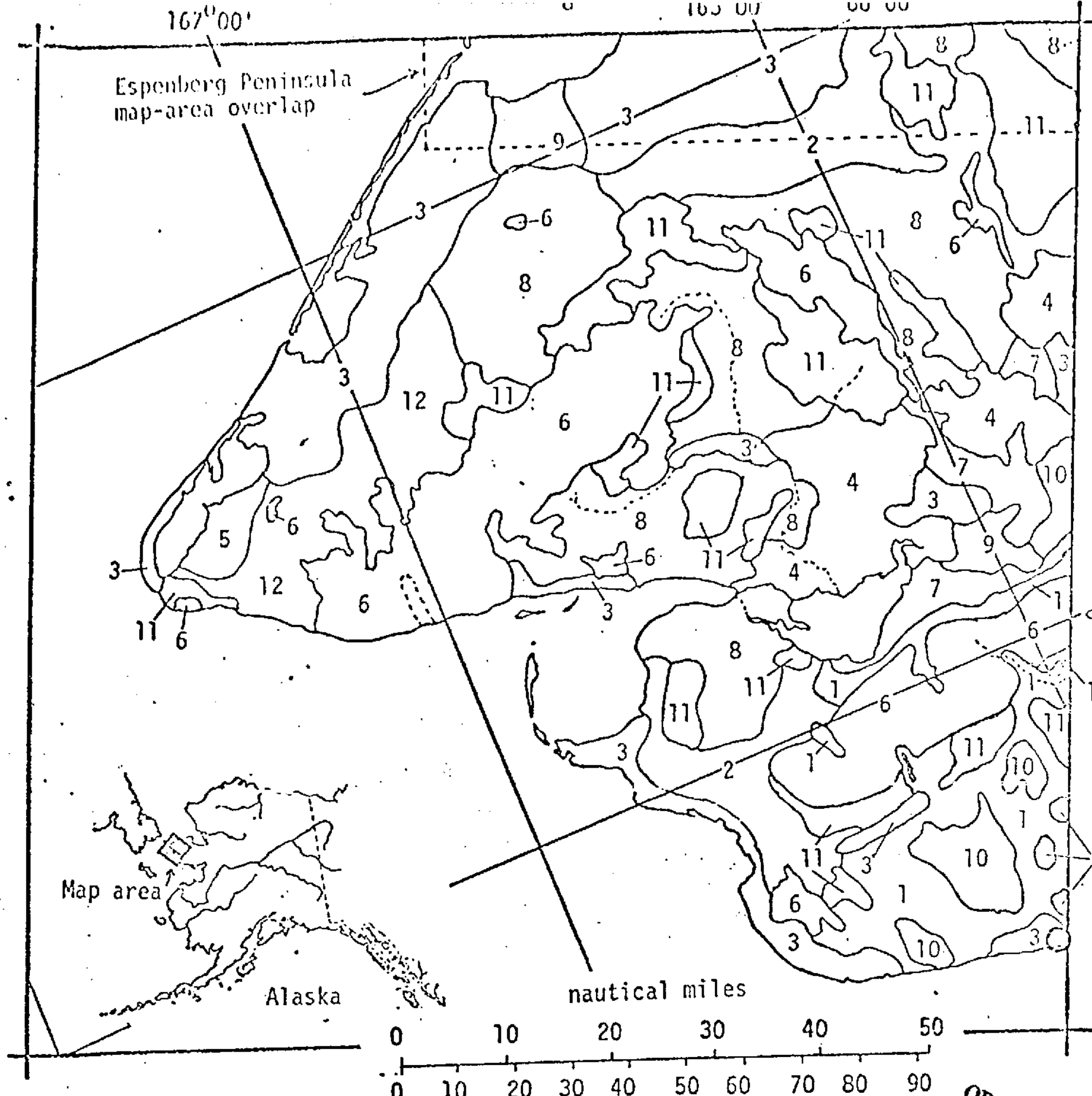

Figure 2.

VEGETATION MAP OF THE WESTERN SEWARD PENINSULA, ALASKA

based on ERTS image 1009-22095

1. Shrub Thickets
2. Upland Tundra
3. Wet Tundra
4. Fire Scars
5. Senescent Vegetation
6. Highland and Mountain Areas with Sparse and No Vegetation
7. Possible Grassland Tundra
8. Shrub Thicket-Upland Tundra Mosaic
9. Shrub Thicket-Wet Tundra Mosaic
10. Shrub Thicket-Highland/Mountain Areas Mosaic
11. Shrub Thicket-Upland Tundra-Highland/Mountain Areas Mosaic
12. Upland Tundra with Some Senescent Vegetation

Reference: Anderson and Belon 1973

Methods

The image used for mapping is a photographic print in simulated color-infrared format at a scale of 1:250,000. It was made from NASA ERTS-1 Scene No. 1009-22092, taken by the satellite at an altitude of approximately 500 nautical miles on August 1, 1972, at about 1110 hours LST. The product acquired from NASA was a 9-1/2 inch reconstituted, simulated color-infrared transparency. This was printed by projection onto Eastman Kodak direct reversal color print material. The desired scale was achieved by first putting the base map on the enlarger easel and adjusting the projected image to it, using prominent landmarks as guides. The base map comprises parts of the Bendeleben, Kotzebue, Shishmaref and Teller sheets in the U. S. Geological Survey 1:250,000 Alaska Topographic Series.

A sheet of transparent plastic suitable for drafting was cut to fit the image. This was placed over the map, and several landmarks prominent on both the map and the image were traced onto it. These comprised lakes, lagoons and the coastline. Other features not readily visible on the image, including stream forks and bench marks, also were traced onto the plastic to facilitate reference back to the map when the plastic was used over the image.

The plastic was positioned over the image by matching the prominent landmarks. Vegetation and other units interpreted on the image were then traced onto it. The plastic had sometimes to be shifted slightly as mapping proceeded, as an exact scale match over the entire map-area was not achieved because of minor differential scale distortion between the

base map and the image. This shifting presented only a slight potential for error because of the considerable number of landmarks, mostly lakes, that were traced onto the plastic. Lakes are abundant in the map-area and are quite distinct on the image.

In preparing for vegetation mapping, the image was carefully examined in order to identify spectral signatures, which are color units, or units of different hue, intensity and brightness, to the extent that this is possible with presumably normal color vision. Strong reflected light was used. Interpretations were based on the assumption that the colors for most land areas resulted primarily from the spectral reflectance of vegetation, since vegetation is generally known to cover the land surface everywhere in the map-area except for sand dunes, coastal mud flats and rocky barrens in the highlands. Areas lacking vegetation, of minor extent, were easily distinguished by their colors which contrasted distinctly with colors indicating the presence of vegetation. With these exceptions in mind, it was further assumed that different colors represented reflectances of different spectrophotometric character from different plant communities and hence that the variety of colors on the image portrayed the variety of plant communities on the ground. Colors representing vegetation include reds, pinks, yellow-pinks and brown-pinks. Non-vegetation areas are represented by blues, blue-grays, brown-blues and, in the case of water, blue-blacks. The terms applied to these colors are somewhat subjective.

Colors were identified to plant community, or vegetation type and association, using field data obtained at several locations by the 1973

Chukchi-Imuruk Biological Survey party. Wherever possible a direct correlation between vegetation type and color was established. These correlations were the basis for extrapolating vegetation interpretations to other parts of the map-area. Information on black and white aerial photographs at a scale of approximately 1:40,000 was also obtained for a few local areas. Interpretations were refined on the basis of physiographic position of the map units, identified through reference to the topographic map, in view of known general relationships of tundra plant communities to physiography.

The terminology used in naming map unit classes according to vegetation types follows the terminology of Racine (1974) as closely as possible. Reference should be made to Racine's vegetation classification for more information on the composition, structure and habitat relationships of the types and associations involved than is presented below. Four of Racine's five primary types are important enough in the map-area to depict: Shrub Thickets, Tussock-Shrub Tundra, Dwarf Shrub Tundra, and Meadows. Most of the associations constituting these types occur in the map-area. Only the Forest and Woodlands type is not mapped, as no stands are known in the area.

Results and Discussion

The preliminary vegetation map of the Espenberg Peninsula is presented as Figure 3. The 14 map unit classes on it are of three kinds. (1) Classes 1, 3, 5, 6, and 7 represent areas wherein a single vegetation type prevails and stands of other types (a) do not occur, (b) are isolated,

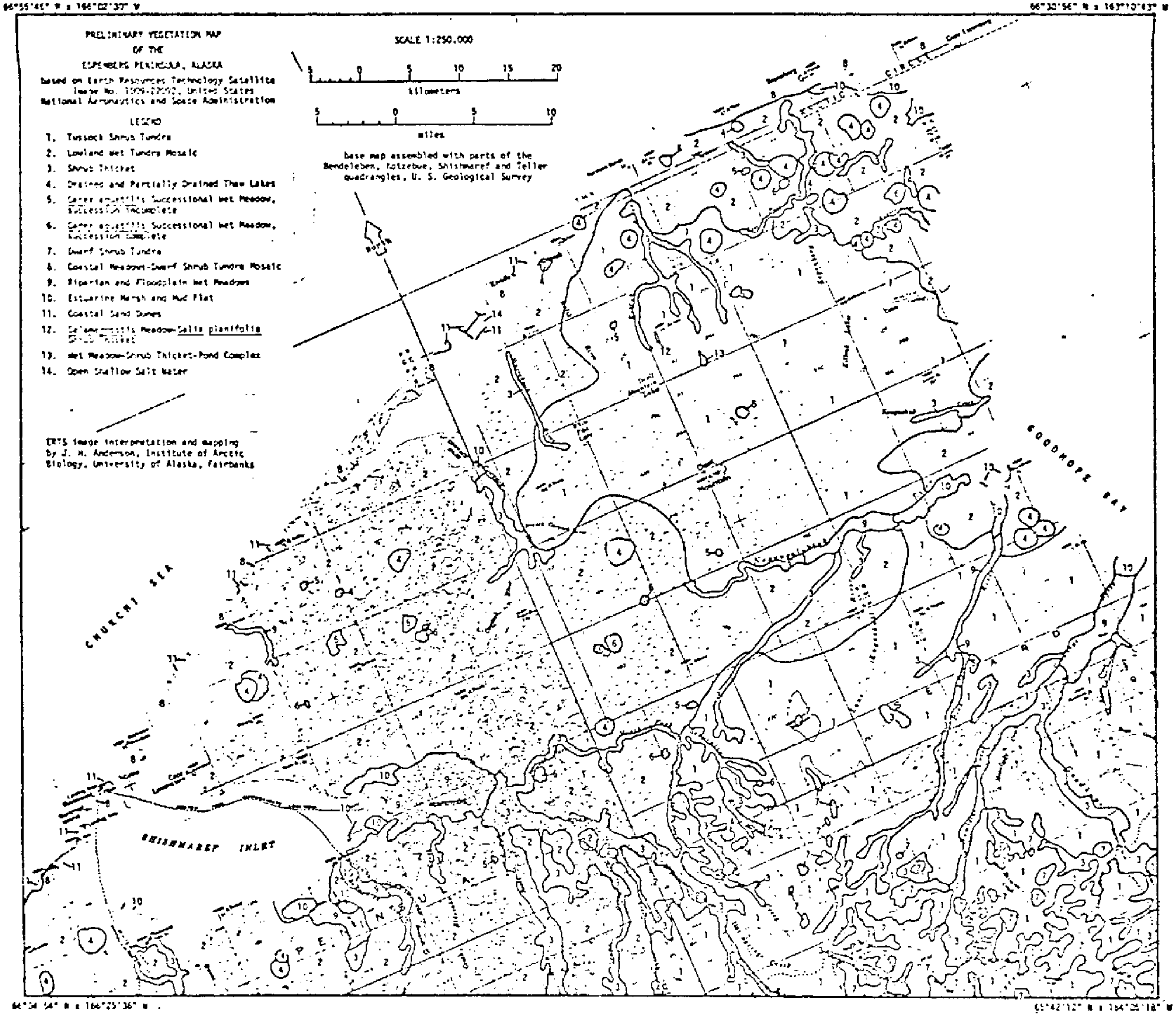
PRELIMINARY VEGETATION MAP
OF THE
ESPENBERG PENINSULA, ALASKA
based on Earth Resources Technology Satellite
National Aeronautics and Space Administration
LEGEND
1. Tussock Shrub Tundra
2. Lowland Wet Tundra Mosaic
3. Shrub Thicket
4. Drained and Partially Drained Thaw Lakes
5. Successional Wet Meadow,
6. Successional Wet Meadow,
7. Dwarf Shrub Tundra
8. Coastal Meadow-Dwarf Shrub Tundra Mosaic
9. Riparian and Floodplain Wet Meadows
10. Estuarine Marsh and Mud Flat
11. Coastal Sand Dunes
12. Meadow-Salix planifolia
13. Wet Meadow-Shrub Thicket-Pond Complex
14. Open Shallow Salt Water
ERTS image interpretation and mapping
by J. H. Anderson, Institute of Arctic
Biology, University of Alaska, Fairbanks
SCALE 1:250,000
kilometers
miles
base map assembled with parts of the
Bendeleben, Kotzebue, Shishmaref and Teller
quadrangles, U. S. Geological Survey
CHUKCHI SEA
SHISHMAREF INLET
GOODHOPE BAY

Figure 3

few and small or otherwise of insignificant areal importance, (c) are of some secondary importance but could not be identified with acceptable certainty because of insufficient field data or (d) could not be adequately discerned on the ERTS image for mapping. The prevailing type may include more than one association. (2) Classes 2, 8, 9, 10, 12, and 13 represent mosaic areas occupied by two or more vegetation types in stands of approximately equal areal importance and where the tesserae (a) are too small to map individually and label at a scale of 1:250,000, (b) could not be delineated because of widespread intergradation or (c) could not be identified because of insufficient field data, even though distinct on the ERTS image. (3) Map unit classes 4, 11, and 14 represent landscape features best identified in other than vegetation terms, although vegetation is a prominent component of the drained thaw lakes represented by class 4.

The map unit class descriptions below are tentative pending revision and validation based on field studies designed according to the findings of the vegetation analysis, classification and mapping so far accomplished.

1. Tussock-Shrub Tundra

This class represents a major portion of the Espenberg Peninsula east of the 165th meridian. The area represented encompasses an upland landscape where, in general, meso-scale topography would promote soil drainage. It contrasts with the poorly drained lowland area of class 2, covering much of the rest of the map-area. Class 1 represents the three Tussock-Shrub Tundra associations, of which Eriophorum vaginatum Tussock-Shrub Tundra is probably the most widespread.

2. Lowland Wet Tundra Mosaic

This class represents the abundant low lying wet places in the map area except for the larger stream valleys and encompasses a mosaic of stands of approximately equal areal importance mostly too small to map and label individually. The majority of these are of the Meadow vegetation type, with Eriophorum angustifolium, Eriophorum-Carex and Carex aquatilis Wet Meadow associations most extensively represented. The Tussock-Shrub Tundra type also is important here, represented by locally important stands on raised sites of better drainage. Linear stands of the Low-Medium Willow Shrub Thicket association, too narrow to map separately, occur along the many smaller streams.

Numerous drained and partially drained thaw lakes occur throughout the area of class 2. Many of these are contiguous and constitute complexes. These complexes and isolated drained thaw lakes, some of considerable size (see class 4), are conspicuous on the ERTS image and therefore appear to be highly characteristic features of the lowland wet tundra landscape.

3. Shrub Thicket

This map unit class represents the wider linear stands of riparian willow shrub thicket throughout the Espenberg Peninsula and the larger stands of upland willow thickets in the southeast. The Low-Medium Willow Shrub Thicket association is most abundantly represented. Low willows around 1 m in height dominate in riparian stands in the north and northwest parts of the map-area and in the seaward segments of stream valleys where classes 9 and 10 are not mapped. Medium height thickets dominated by willows around 2 m tall are the common expression of this association along stream valleys and on some slope sites around lakes in the central and south-central

parts of the map-area. Medium height thickets also are important in the highlands in the southeast, where there also are a few stands of the Tall Willow Shrub Thicket association, particularly around Serpentine Hot Springs. Stands of the Alder Shrub Thicket association are scattered in the map area; for example, a number of stands too small to map separately from the tussock-shrub tundra matrix are known in the vicinity of North Killeak Lake. There also are some small stands of tall willow shrub thicket in this and similar areas, including those represented by units 12 and 13.

4. Drained and Partially Drained Thaw Lakes

As stated above, these are conspicuous in the area represented by class 2. A drained thaw lake is here defined as one with little or no open water apparent on the ERTS image. A partially drained thaw lake is one retaining some open water, in most cases as small arcuate lakes around the perimeter. The genesis and evolution of thaw lakes in the Imuruk Lake area was treated by Hopkins (1949); presumably thaw lakes on the Espenberg Peninsula undergo a change sequence similar to the one he described.

Drained and partially drained thaw lakes appear from their various spectral signatures to include a vegetation of some diversity. Eriophorum angustifolium, Eriophorum-Carex and Carex aquatilis Wet Meadow associations seem to be particularly well represented in them. Their significance was not realized until after the field season when the ERTS image was studied. Therefore no special attempt was made in the field to examine their vegetation. Only the larger or otherwise more conspicuous of the drained and partially drained thaw lakes are mapped. A relationship between the phenomena of class 4 and of classes 5 and 6 is suspected, but no firsthand

knowledge of it is available yet.

5 and 6. Carex aquatilis Wet Meadow. 5: Succession incomplete; 6: Succession complete

These map unit classes represent stands of what is possibly the Carex aquatilis Wet Meadow association which, as is here hypothesized, develop as some thaw lakes drain or as succession otherwise progresses from open water to closed vegetation. That a succession is involved is indicated by the occurrence of various apparent stages. These include an open lake stage, a stage in which a lake is narrowly ringed by Carex aquatilis wet meadow, one in which the areas of open water and this vegetation are more nearly equal, and finally a stage in which open water has, or nearly has disappeared and been replaced by this vegetation. The latter stage is manifest in several locations where vegetation appears on the ERTS image but where lakes are shown on the older topographic map. These locations are mapped as unit class 6. Similarly, intermediate stages, depicted as class 5, are indicated by lakes smaller than when the topographic map was made and now ringed by Carex aquatilis wet meadow within the original lake margin.

The 1:250,000 scale maps were based on aerial photographs and surveys of 1949-1951, and the ERTS image was obtained about 22 years later, in 1972. Thus it appears that this succession occurs rapidly. The no. 6 unit just southeast of Lake 105 near the center of the map is now vegetation, whereas in 1950 a sizable body of water was present here.

A succession hypothesis based on lake drainage or substantial water level lowering seems more plausible than one based on the more familiar bog formation process wherein a mat of peat bearing live vegetation

develops centripetally in a lake. It is unlikely that the latter would occur at anywhere near the observed rate, particularly in this subarctic region. Thus it remains to examine this phenomenon phytocenologically, to test the hypothesis that succession of some kind is occurring and, if drained and draining thaw lakes are involved, to determine why *Carex aquatilis* wet meadows only infrequently develop and predominate, whereas the majority of drained thaw lakes, including those of class 4, apparently contain a different vegetation. Perhaps this *Carex aquatilis* Wet Meadow vegetation represents a stage in further succession. The uncertain identity of this vegetation, based on minimal field data, needs to be checked, and its composition and structure need to be more thoroughly determined.

The phenomenon represented by map unit classes 5 and 6 was largely unnoticed prior to study of the ERTS image. A systematic survey of the Espenberg Peninsula, or similar areas, using ERTS imagery in conjunction with older maps and aerial photographs could help identify additional examples of it.

7. Dwarf Shrub Tundra

Stands of this vegetation type are of considerable areal importance in the highlands in the southeastern part of the map-area. The Barrens association seems to be represented by the largest and most widely distributed stands and to be the most distinct on the ERTS image. A few locations of the other associations are known, particularly of *Dryas* Dwarf Shrub Tundra around North Killeak Lake and *Carex bigelowii* Dwarf Shrub Tundra near Serpentine Hot Springs. It is likely that stands of all five associations, either too small to map or indistinct on the ERTS image,

are widespread on the better drained low crests and summits throughout the tussock-shrub tundra area of class 1.

8. Coastal Meadows-Dwarf Shrub Tundra Mosaic

This class covers a mosaic of several vegetation types occurring in stands too small to distinguish on the ERTS image. These stands occupy a coastal zone consisting of a sequence of beach ridges and intervening troughs (Fig. 4). Barrens and Dryas and Carex bigelowii dwarf shrub tundra associations form a succession on the crests and upper slopes of these beach ridges, this succession trending generally from the former, younger stages near the ocean to the latter stage toward the interior. Between the ridges, Eriophorum angustifolium, Eriophorum-Carex and Carex aquatilis Wet Meadow associations are represented on flats and in troughs. In these topographically low areas ponds occur, some of which contain communities of aquatic species. In addition, stands of the Elymus arenarius Meadow association occur on some sand dunes, especially those forming the front line of dunes on the ocean side of the coast.

9. Riparian and Floodplain Wet Meadows

The vegetation represented by this class occurs on floodplains in the lower, seaward segments of several of the larger rivers. Many of the smaller stream valleys contain a similar vegetation in their seaward segments but, as with many occurrences of the Shrub Thicket type, this vegetation is in stands too narrow to map individually.

Stands of several wet meadow associations may be represented here, with the most important being the Carex aquatilis Wet Meadow association. These stands contain an open low willow stratum on the more inland sites

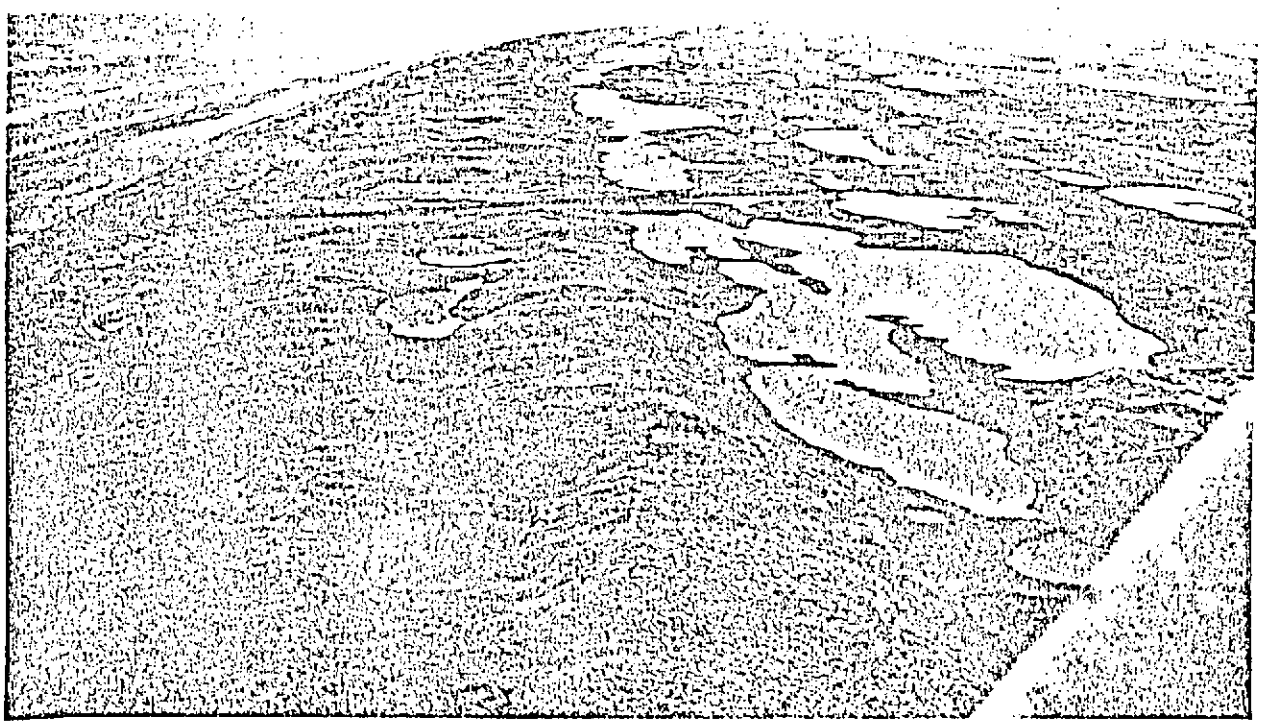

Figure 4. Low altitude aerial view eastward over the beach ridge zone at Cape Espenberg.

and scattered low willows on sites closer to the sea. As such, the riparian and floodplain wet meadows class may be a transition between Shrub Thicket and the wetter coastal meadow associations. The several class 3 units in the vicinity of Cape Espenberg may contain stands of this transition vegetation. Field observations indicate a general decrease in abundance and stature of willows northwestward across the map-area.

10. Estuarine Marsh and Mud Flat

This map unit class represents river mouth areas characterized by open shallow water and wet mud flats where plant cover is absent, sparse or otherwise not dense enough to preclude the predominate appearance of water on the ERTS image. These areas may lie partly below high tide level. This class represents in addition a few non-estuarine areas of otherwise similar physiographic position in the vicinity of Cape Espenberg. Vegetation here, not yet studied, may be a saline aquatic meadow or marsh type.

11. Coastal Sand Dunes

This class represents areas of surficially unstable sand dunes upon which a plant cover is scant or lacking. There are several such areas along the northwestern coast. It is likely that small stands of the *Elymus arenarius* and Salt Grass Meadow associations occur within these areas, and some dunes may bear scattered individuals of *E. arenarius* and a few ecologically related species.

12. *Calamagrostis* Meadow-*Salix planifolia* Shrub Thicket

A single occurrence of this two-component mosaic is depicted adjacent to North Devil Mountain Lake on the northwest. It was mapped

because it was visited and described by the field party and was distinct on the ERTS image. Also, although small, it is isolated and therefore easily mapped and labeled.

13. Wet Meadow-Shrub Thicket-Pond Complex

The single area represented by this map unit class is adjacent to North Devil Mountain Lake on the east and was also seen by the field party. The shrub component includes alders and willows. As with class 12, the feasibility of depicting it was an opportunity to make the map somewhat more informative.

14. Open Shallow Salt Water

Only one unit of this class occurs on the map, between two sand dune areas a few km southwest of Kividlo. Here the ERTS image was interpreted as showing open but very shallow water. A mud flat may appear at low tide.

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